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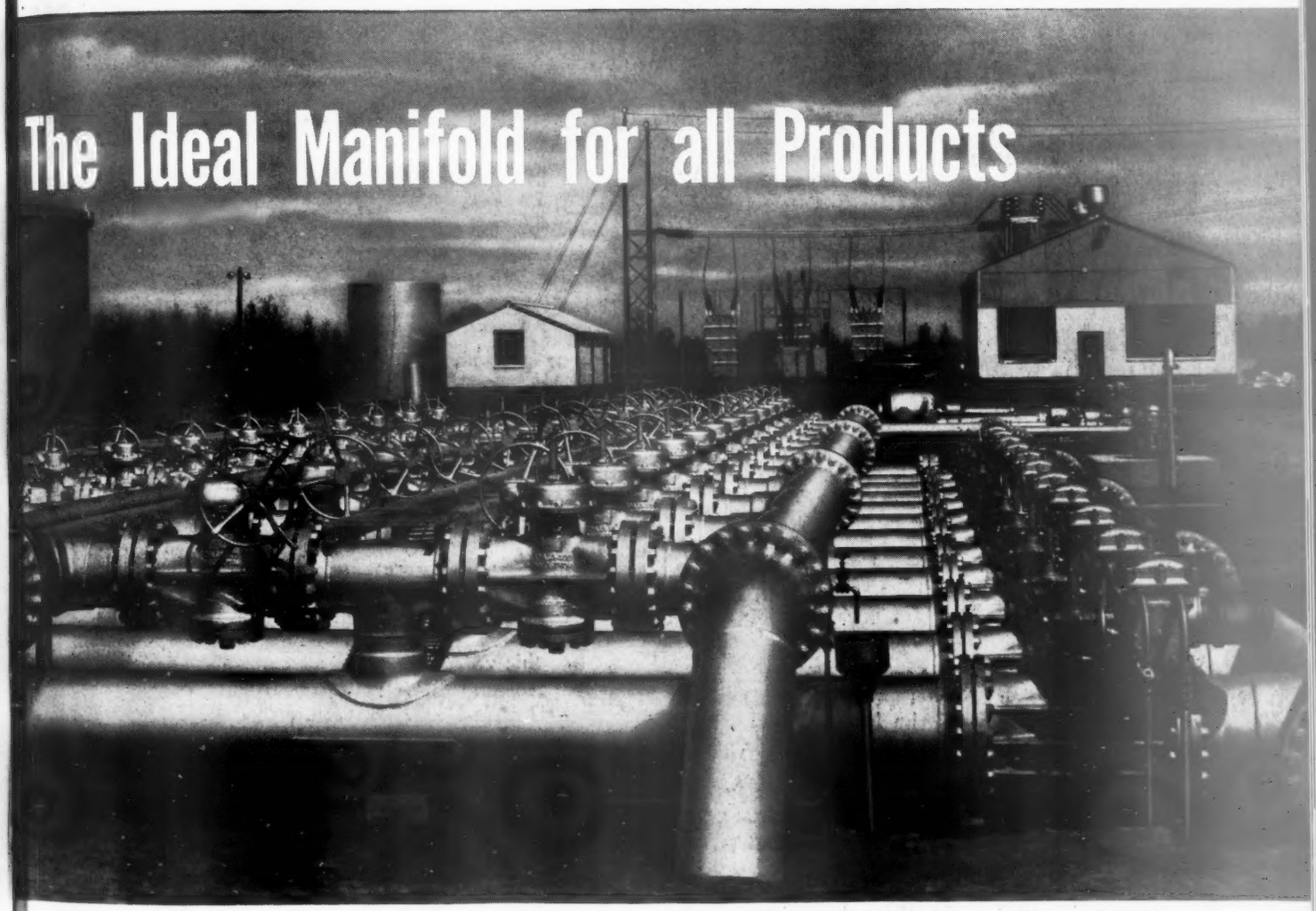

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LUBRICANT SEALED TO KEEP UPKEEP DOWN

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AUGUST 1952

Working Storage

Aerial view of Union Oil Company's Avila, California pumping station showing tanks with floating roofs.

FOR A WORKING PUMP STATION

The endless job of receiving crude and delivering it aboard tank ships is one that requires a real working terminal. One of the hardest working of them all is the Union Oil Company's Avila Pump Station.

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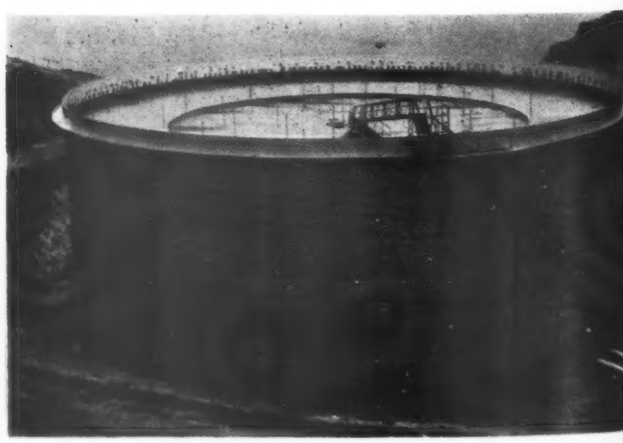
Tanks equipped with Horton Floating Roofs reduce evaporation losses, corrosion and fire hazard. Floating directly on the surface, the entire bottom of the roof is normally in contact with the liquid in the tank. There is no air-vapor mixture above the liquid to be vented and lost. Fire hazard and corrosion are reduced as a result of the elimination of this vapor space.

Horton Floating Roofs are built in three types —Double-Deck, Pontoon, and Pan. To help you select the roof most suitable for your operation, write our nearest office for Bulletin B.



Right: 142-ft. diam. by 48-ft. tank with a Horton Pontoon Floating Roof at Avila, Calif.

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THE Petroleum Engineer

COMBINED EDITION

• Drilling and Producing • Refining and Gas Processing • Oil and Gas Pipelining

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The PETROLEUM ENGINEER Publishing Company, Irwin-Keasler Building, DALLAS 1, TEXAS. W. L. LOVE, *President*; W. T. BRYAN, *General Manager and Treasurer*. Editorial Staff—K. C. SCLATER, *Vice President and Editor-in-Chief*; ERNESTINE ADAMS, *Managing Editor*; JACK MENNEER, *Editor, Drilling and Producing*; ARCH L. FOSTER, *Editor, Refining and Gas Processing*; FRANK H. LOVE, *Editor, Oil and Gas Pipelining*; RICHARD SNEDDON, *Editor Pacific Coast*, 1106 B North Louise Street, Glendale 7, California. Phone, Chapman 5-1951; MARY MORRIS LYMAN, *Assistant Editor*; HENRIETTA O'BANNON, *Art Editor*. Advertising Staff—T. J. CROWLEY, *Vice President and Advertising Manager*; New York—JOE B. WOODS, 52 Vanderbilt Avenue, New York 17, New York. Phone MUrray Hill 4-1880; Chicago—E. V. PERKINS, 53 West Jackson Blvd., Chicago 4, Illinois. Phone HArrison 7-883; Los Angeles—RICHARD P. McKEY, Bendix Bldg., 1206 South Maple, Los Angeles 15, California. Phone Prospect 3919; Dallas—ABBOTT SPARKS, Irwin-Keasler Building, Dallas 1. Phone STerling 4403; ABBOTT SPARKS, *Director of Promotion*; ED SEALY, *Promotion Manager*; ROYAL COURTNEY, *Circulation Manager*.
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A Shortage the Industry Cannot Afford

According to the Engineers' Joint Council, the present shortage of engineers in industry is 60,000. The needed normal replacement and growth needs for industry are 30,000 per year. In a protracted national emergency the number needed to fill government and industry requirements is 40,000. This year the number of engineering graduates is expected to be 28,000; in 1953, 19,000; and in 1954, 12,000 to 17,000. From these figures it is evident that industry requirements as a whole for engineers will be only half met.

The acute shortage of engineers, such as these figures indicate, is of concern to the petroleum industry, in which the shortage has been apparent for several years. Although the shortage is not confined to any one branch, it is particularly acute in the drilling, refining, and gas processing branches of the industry. Considering that it has been called upon to increase its productive capacity, and also its reserve productive capacity, the industry has cause for concern. Take drilling for example. For the last half of 1952, 25,000 wells are called for, and 55,000 in 1953. It is estimated that 60,000 wells will have to be drilled in 1954, and 65,000 in 1955 if domestic production is to approach the same percentage of reserve productive capacity that we had at the beginning of World War II. Even with this ambitious program, the industry will still be a long way from its goal. The industry cannot afford to let its progress lag.

Drilling today is a far cry from that of twenty or more years ago. The drilling of deep wells demands technical skills in order to cope with the complex and difficult problems that may arise. Deep wells are now so costly that failure to take account of and prepare for exigencies can result in tremendous losses. If footage costs are to be reduced it will require, among other things, greater concentration of effort to improve the design and construction of equipment and the materials that go into the manufacture of equipment—a program that involves engineering and technical skills of a high order.

A plea for giving wholehearted consideration to the scientific operation of oil reservoirs in the early stages of development was voiced recently by the executive officer of a large oil company. Proper attention in the early life of a field renders unnecessary much of the expense and difficulties experienced in its later producing life. In the Rocky Mountain region, for example, where drilling costs are above average because of difficult terrain, inaccessibility, and the character of the formations encountered, operators should accept the challenge to give science an opportunity to help drill wells deeper and cheaper and produce more oil economically.

The petroleum industry offers a wide field of activity for the graduate engineer and the man with technical training. There are many opportunities for the engineer; these should be brought to the attention of young men. Greater efforts should be put forth by the industry in counselling young men finishing high school on the advisability of following an engineering career in oil. If this is not done, the industry, to its own detriment, will continue to be deprived of valuable engineering skills that it cannot afford.

—K. C. S.

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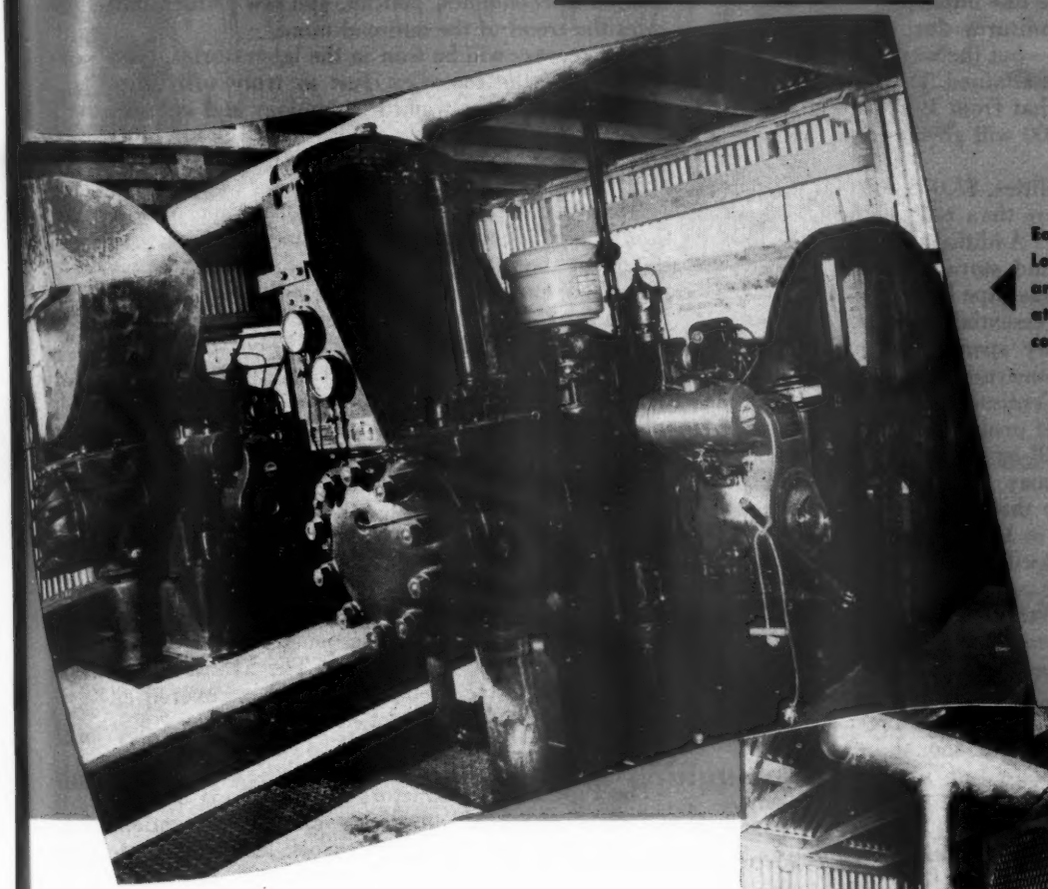
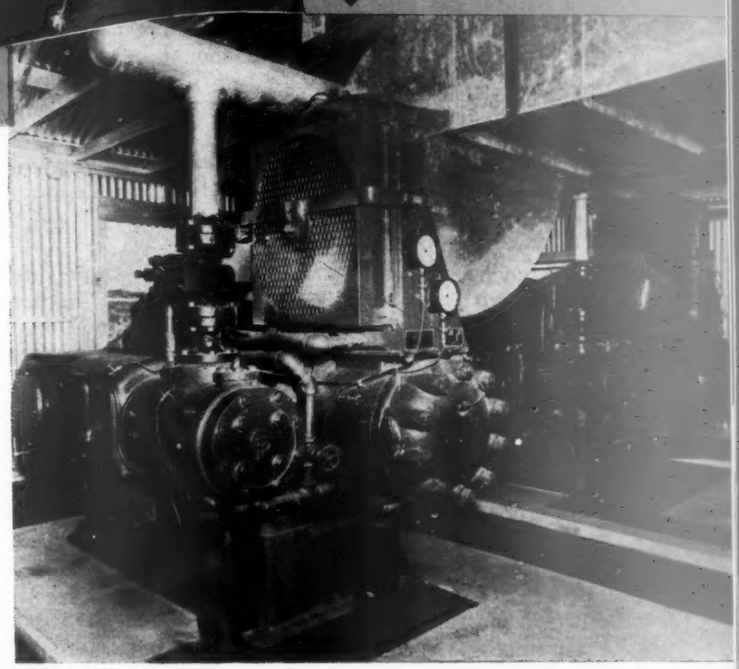
with 2 "Oilwell"-Lorain Direct-Connected Gas Booster Units



Each unit is driven by a Model "A" Lorain Gas Engine with 13" bore and 13" stroke. It operates on gas at 300 rpm to develop 50 hp. under continuous running conditions.

The engine and compressor are both mounted on a cast-iron base and the single-stage compressor with 9-inch stroke is driven direct from the engine crankshaft.



KEWANEE OIL COMPANY, PAMPA, TEXAS, has installed two "Oilwell"-Lorain Direct-Connected units for re-pressuring some 30 producing oil wells.

Each of these units is designed to pump natural gas with an intake pressure of 100 psi. and discharge pressure of 500 psi., and to handle 500,000 cubic feet of gas every 24 hours. At present the units are being operated with intake pressure of 50 to 60 psi. and discharge pressure of 235 psi. and are handling a total volume of 600,000 cubic feet per day.

"Oilwell" is the only supplier of slow speed direct-connected gas booster units of this size in the industry. Your nearest *"Oilwell"* representative will gladly give you complete information about these and the other gas booster units in the "Oilwell" line.

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With the EDITORS.....

It's a Lot of Money

The gas and gas pipe line industries established a record high for expenditures during the last five years—$5,100,000,000—but the next five years will see an even higher peak attained. The American Gas Association estimates that from 1952 through 1956 a total of $5,600,000,000 will go into new facilities and plant expansion.

On transmission facilities, $3,075,000,000 will be spent, considerably more than half of the total gas industry expenditures. Additionally, $82,000,000 will go into underground storage facilities, which are closely allied with gas pipe lines.

Despite shortages of essential pipe and other materials, the gas industry spent a record $1,461,500,000 last year for construction of new faciliites, said the AGA report. Continued allocation and material difficulties make it problematical whether this level of expenditures will be reached for the current year; however, 1953 may be a different matter. "Current plans indicate that the record established in 1951 may be broken in 1953 when estimated construction expenditures will total $1,681,000,000," says the report. "This estimate reflects plans for major expansions of existing systems to be started in 1953, as well as one new pipe line from the Gulf Coast area to the Middle West, and the initiation of a natural gas pipe line, either from Canada or the Southwest, to serve the Pacific Northwest."

The association's estimates should be relatively accurate, as they were based on reports submitted by companies representing more than 95 per cent of total revenues in the industry, and on a special survey among a substantial number of pipe line and major distribution companies. F.H.L.

Afraid to Educate

French industry is afraid to educate "too many specialists" and thus is suffering seriously in her drive to recover from World War II. The traditional educational systems of Western Europe are inadequate for the job of training a number of skilled technicians to get the job done in European industry, Dr. Harold Vagtborg, Southwestern Research Institute president reports recently. Colleges that should matriculate several hundred new technological students each year accept possibly 40, Vagtborg says, consequently industry goes elsewhere and France must buy products she should manufacture.

Essentially this situation is repeated in large measure in most countries of the world. It is one of the aftermaths, the "hangovers" from global war. Our own military forces, pressed for personnel, has done our productive capacities untold harm by taking, often apparently willingly, technical men and students without regard to our acute shortage of engineers and other technically trained specialists. Germany is better off in the matter of technically trained personnel than is France, who "doesn't understand technology and industry." "Their best people are trained in economics, politics, and law" which indicates the trend of the national mind.

Future wars will be won in the laboratories, classrooms, and the factories. Just as truly will future peace prosperity be won by technology and industry.

—ALF.

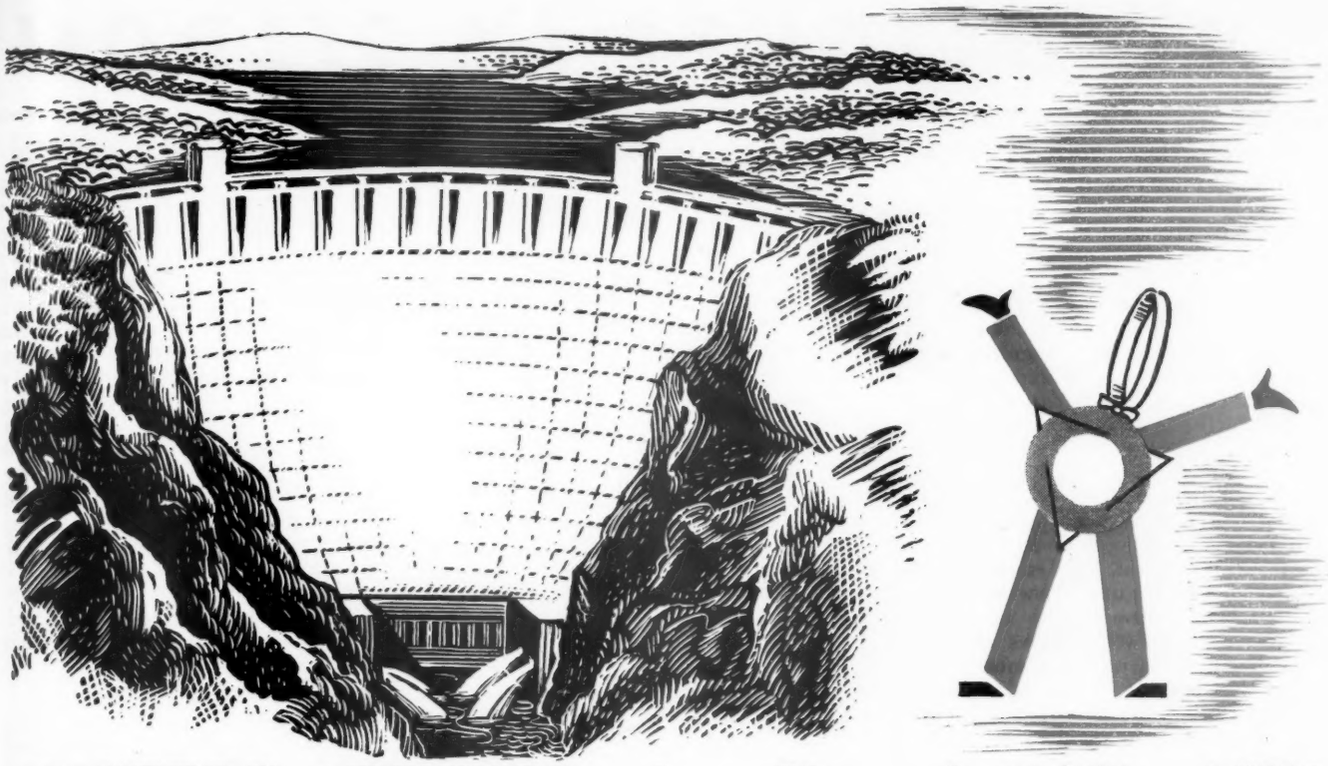
Too Much Refining

Atop all the hue and cry for more crude production, more refining capacity, comes the arresting statement that this country's refining capacity has processed too much crude over a period of more than a year. The need for reserve supplies of petroleum products for national defense is not questioned, remarks Shamrock Oil and Gas Corporation sales manager Leo J. Wilmeth, addressing Pennsylvania oil men. But certain divisions of the industry are building more refining capacity than consumption requires, he indicated. Coupled with all this the industry is fighting to hold its ground in the matter of necessary allowances in exploring for and producing oil. The oil man gets only a "hunting license to find oil" when he starts looking for it, he has no guarantees that he will find it or that the money so spent will be recovered. He must have adequate returns to continue the industry. The habitual foresight and initiative of the industry has covered all contingencies, and must not be lost.—ALF.

Contractors Look Ahead

The Pipe Line Contractors Association is already actively looking ahead to its annual convention, which will be held at the Shamrock Hotel in Houston, Texas, January 19, 20, and 21, 1953. Literature has been dispatched from the central office in Dallas to members, associate members, and all others interested in the meeting, which gives specific data to those interested in exhibiting, as well as information for the procuring of hotel reservations.

The custom of the association is to hold an exhibit every other year and 1953 is the year. Using past experience as a guidepost, every possible effort is being made to present an outstanding "Show". The management of the Shamrock has been induced to construct a cement midway 12 ft wide and 240 ft long directly across the street from the entrance to the hotel and at right angles to the sidewalk running parallel to the triangular display area. Also, 280 ft will be reserved along this sidewalk, 140 ft on each side of the midway. Light standards and lights will be spaced every 20 ft around this display. In the past there has been some dissatisfaction among exhibitors regarding the facilities available to them. These new arrangements, however, should remove all such dissatisfaction and should make for an attractive show, which, together with the always attractive business and technical program, doubtless will result in an attendance exceeding even that of the record-breaking 1952 convention.—F. H. L.



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HIGHLIGHTS IN OILDOM

Steel Workers Back on Job

The 53-day steel strike has been brought to a close. President Truman with CIO president Phillip Murray and United States Steel president, Benjamin Fairless, after a day-long session in which an intense effort was made to bring the strike to an end announced to the newspapers that an agreement had been reached. But the walkout has taken its toll cutting deep in national defense, and idling nearly 2,000,000 workers during its long run.

Agreement calls for a 2-year contract with a little over 21 cents an hour wage hike and fringe benefits, plus a modified union shop, stumbling block to an earlier settlement. All employees not belonging to the union now are exempt from being compelled to take out a union card; new employees must sign application for union membership. If they fail to notify the company within 15 to 30 days of employment that they wish to quit the union, they must stay in. It also provides for a 15-day withdrawal period from the union after each contract is up. It was also announced that the steel companies have been granted a price boost that averages out at $5.64 a ton for their product.

Anglo-Iran Arbitrator

In a last-ditch effort to settle the dispute between Anglo-Iranian Oil Company and Iran, Britain has announced that it will apply to the International Court at the Hague for an arbitrator. Little hope is held for any settlement, however, as Iran has declared it will not discuss the affair with an arbitrator and now that Premier Mossadegh's group of anti-British sympathizers are apparently back in control of things, hopes are even dimmer. Iran refused to arbitrate the request of compensation for the Abadan refinery and oil well installations with representatives of the World Court last May. It ruled that the matter was purely domestic and the World Court did not legally have a right to pass on it.

Oil From Coal Cost Survey

A new study of cost of oil from coal will reveal a 10 per cent profit could be made by a plant costing $40 to $50,000,000, Dr. W. C. Shroeder, assistant director of the Bureau of Mines has reported. The B of M is working on new cost estimates for making liquid fuels from coal. That profit margin based on use of 50 per cent investment capital would be double what was figured in earlier studies involving possible plants costing about $400,000,000, Shroeder reported. The Bureau aims at production of liquid fuels with output of about 3000 bbl of liquid products daily, but would increase production of chemicals from some 18 per cent of the total liquid product to about 57 per cent.

Oil Output Up After Quake

California's recent earthquake and series of tremors that followed have done little damage to its oilfields, according to the Conservation Committee of California Oil Producers. Biggest loss was suffered at the Paloma oil field, south of Bakersfield, where parts of the $10,000,000 gas-distillate cycling plant were destroyed or damaged by a fire raging out of control. Wells in several fields were shut in for a few hours but they apparently suffered no damage from the quake itself. The odd thing is, and something that was noted in Oklahoma after that state sustained various earth movements, Richfield Oil Corporation and other producers, reported several of the wells produced more oil after the quakes than before.

Oil Allowables Set

Crude oil allowables were given one of the sharpest boosts on record in Texas this month, but Louisiana decided to cut its maximum permissible output slightly.

Texas Railroad Commission set its allowable output of crude at 2,924,306 bbl daily this month, a boost of 187,392 bbl over the July figure. That is the highest the commission has authorized since September, 1950. Louisiana's cut was not too sharp, 4530 bbl a day, directly in opposition to Texas' policy. Louisiana will produce 670,812 bbl daily this month.

South Louisiana fields were given a goal of 557,340 bbl daily this month, and those in the northern part of the state received 113,472 bbl.

Oil Progress Week Set

The oil industry is making preparations for its 1952 Oil Progress Week, to be observed October 12-18, inclusive. This will be the fifth sponsored by the Oil Industry Information Committee of the American Petroleum Institute. Theme of the 1952 observance is woven around the tremendous strides made in gasoline quality over the last 25 years alone, API reports. This is symbolized by the statement that "2 Equals 3"—that two gallons of motor gasoline will provide the same work energy that required three gallons back in 1925.

Private Enterprise Endorsed

The National Society of Professional Engineers has adopted a resolution calling for the development of the nation's natural resources by private enterprise, L. L. Dresser, president, has announced. "Professional engineers are deeply concerned about the creeping socialism that is engulfing many areas of our nation," Dresser declared. "It should be pointed out that private developments pay untold billions of dollars in taxes that are available for the general welfare, while public projects pay no taxes, while using tax money for these developments."

Canadian Tar Sands Oil

Although our oil lines from Venezuela and the Middle East are vulnerable to Russian submarines in event of all out war, Canada could provide from 100 to 300 billion barrels lying close to the surface in the tar sands of northeastern Alberta. Three American, 10 Canadian, and 1 Swedish companies are beginning work this summer to seek a method of regaining this oil for sale to the American market at a cost competitive with oil produced from conventional wells. S. M. Blair, Toronto engineer, reported to the Alberta government that oil could be brought to Lake Superior by pipe at a total cost of $3.10 per barrel. The mixture of oil and sand is about as thick and heavy as tar, and stretches for 100 miles along the Athabaska River and its tributaries in beds 100 to 200 ft thick.

Nova Scotia Oil Search

Millions of dollars will be spent in Nova Scotia in a big oil and gas search, Canadian parliament member Carl E. Nickle told the Halifax Commercial Club recently. He told his audience that more than half Nova Scotia's land area is geophysically favorable for oil and gas. Nova Scotia Oil and Gas Company will carry out the large exploration program under an agreement with the provincial government. Drilling is already underway at one location.

Pemex Seeks Investigation

Mexico's government petroleum monoply, Pemex, has asked for federal investigation of accusations by Atalio Vazquez Pallares, congressman from Michoacan State, that it is violating the law by delivering Mexican oil to foreigners. In charges made to the Mexico City newspapers, Pallares charged that Pemex drilling contracts, under which Mexicans and companies from other countries can drill wells in exchange for a percentage of oil found, are illegal. Pemex filed request for formal investigation with federal attorney general.

PAD Oil Plan Abandoned

Readjustments in petroleum-industry operations since the shutdown of Iranian production in June, 1951, have been so successful that it is now possible to terminate Plan of Action No. 1 of the Petroleum Administration for Defense, Secretary of the Interior Oscar L. Chapman announced.

This plan established the mechanism by which 19 United States companies engaged in foreign operations could cooperate under PAD direction, in specific transactions to supply defense-necessary petroleum to friendly foreign nations. Transactions involving 45,987,000 bbl of crude oil and refined products were covered in 25 schedules approved and issued by PAD administrator in charge of foreign oil operations.

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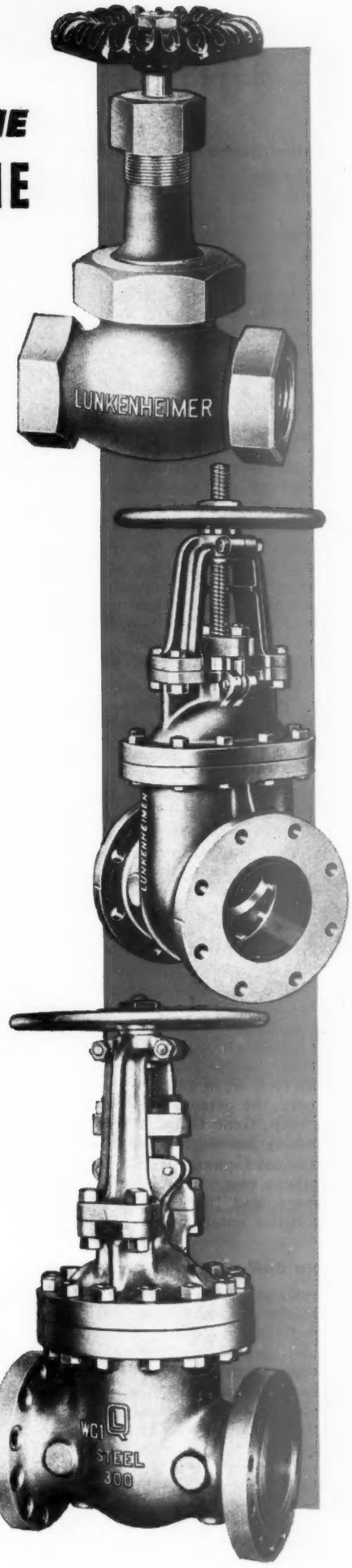

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PETROLIC PERSONALITIES

DICK SNEDDON

Californians Host AAODC Directors

On the eve of the AAODC annual directors meeting, Ned Brown, president of the California chapter, and his fellow members, played host to the visiting delegates at a very lovely dinner party in the Los Angeles Petroleum Club. Such business as had to be transacted was disposed of quickly and the balance of the evening was largely devoted to brief reports and introductions, mostly we imagine for the purpose of getting acquainted. Two time president of AAODC, A. W. "Tommy" Thompson of Thompson-Carr Drilling Company, Houston, made a short but interesting address in which he discussed the prospective effect of the steel strike on the future of contract drilling, and also gave out with some highly pertinent statistics for the years 1950, 1951, and part of 1952, all well worthy of consideration by the association and its members.

Among those in attendance was George McQueen, the Fort Worth chap who thought Ned Brown's request for silence was an invitation to speak and immediately launched into a bit of silver voiced oratory that would have done credit to William Jennings Bryan. It was quite late in the proceedings before he learned of his error but so far as we could see, he wasn't at all distressed over the matter. Sitting next to George was Tom Pike—Mr. Republican—the prexy of Pike Drilling Company and a master of so many instruments that he can muster a symphony orchestra without leaving home; and beside him was Karl L. Kellogg, director of all the Kellogg enterprises and the only two-time chairman, we believe, of the California chapter.

The Delegates Gather In

Down from Denver, Colorado, came Joe Dunbar, president of Dunbar Drilling Company, and proprietor of as lovely an Irish brogue as ever was heard outside of County Mayo. And from Wichita, Kansas, came W. S. Brunson of Brunson Drilling Company, a collegiate looking young chap who looked as if he might be on his way to the Olympic Games. The Kellogg sons were there too, Joe and Forest, a pair of cleancut, well behaved chaps who have tied into the drilling business in a way that must be very pleasing to their dad. Accompanying them was George Pettit, also of the Kellogg staff, who seemed as usual to be enjoying himself to the full. Then there were Harry Hillman who, between board of education meetings, is prexy of California Production Service, and his right hand man, Charlie Eastman, one of the nicest people in town, whose wife, incidentally, has been Bing Crosby's secretary for years, and who himself is quite a pumpkins.

Alongside of Charlie was H. D. Paxton, the lad who took over in the AAODC public relations department when Jack Westsmith took off in another direction. Then there was R. B. Montgomery, the personable Pike Drilling chap, and the good looking veep, Gene Graham from the same institution; quiet, unassuming but mighty capable John McEwen of the California Statistical Committee; Ray Plyler, the friendly Enterprise Oil Company executive who helped us identify many of the out-of-towners, and Joe Mitchell who is associated with him in the Enterprise enterprise.

Ham Bell versus John Moran

Loffland Brothers was well represented with big genial Bob Wire, the president in from Tulsa, and several others, including John Grant, student of the classics and local top man; Cotton Holder, general superintendent of western operations and one of the industry's best story tellers; Earl Moore, the cheerful chap who supervises Los Angeles Basin operations; and Lee Daniels, the quiet, gentlemanly, and efficient office manager. Carl Gates of Fowler Drilling came up from Long Beach and pleased us no end with some well couched but totally undeserved flattery.

Ham Bell, the front half of Bell and Burden, engaged in some good natured chaff with John Moran of Witchita Falls who seemed to be one of the most popular people at the meeting, while Harry Buchanan, also from B and B smiled his approval. John Woodruff, the husky professor from Austin, sat with Glenn Campbell, the Tulsa drilling contractor with the Caledonian moniker; John Holmes, a director from Houston; and another delegate from Wichita Falls, in the person of George Graham of the T. G. and M. Drilling Company. We sat with Mark Gardner of the Delta Gulf Company at Dallas and had a very nice time trading notes. Across the table was Weldon Brigance of Rowan Drilling at Fort Worth, another famous chap whose name we have seen in the public print many a time. Nearby were A. W. Nash and L. G. Kelly of Shamrock Drilling, while George McCarthy, head of the organization sat just a few chairs away.

Ray Love, the A. D. Rushing executive, now fully recovered from an illness that had him down for a while, waved a cheerful hello while we were being introduced to Bill Hall of the Trinity Drilling Company, Odessa, and Dale Mount of the Harry Bess concern of Dallas. Glen Kitchel of Kerr McGee Company traveled all the way from Oklahoma City to be in on the doings, and by his side we noted Ken Guido of Santa Maria Drilling Company; young Bob Walker, the lad who took Art Heiser's place with Brown Drilling, and J. W. Teague of the Columbus outfit in Houston.

Kansans Sneak in Under the Wire

Brad Mills did some advertising for the next convention at Oklahoma City, and Chuck Riemann, the nice young Pike attache, secretary of the California chapter postponed his vacation to take care of the party. Clyde Simpson of the recently formed firm of Kee & Simpson was present in full summer regalia, and last but not least were two lads who had lost their way but finally made it just before the curtain rose, to wit, Charlie Todd of Rine Drilling Company, Wichita, Kansas, and Jim Adkins from nearby Great Bend.

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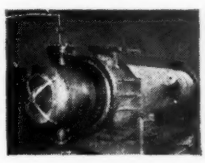

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LETTERS *to the* EDITORS

Gracias

To The Petroleum Engineer:

Would not like to miss a single issue of The Petroleum Engineer, so here is my new address. *Nick Koot,*

Odessa, Texas

In the Majority

To The Petroleum Engineer:

I have always enjoyed reading *The Petroleum Engineer*, and consider it one of the most interesting and informative publications of its kind.

M. D. Hughes,

Petroleum Engineer
Long Beach, California

Pig-Iron Pete's Reprieve

To The Petroleum Engineer:

I have seen your letter concerning renewal of my subscription to *The Petroleum Engineer*. I have read the story of the old Seminole field roughneck with attraction. I have appreciated your kind advice very much. I certainly don't want that to happen.

You probably know that there is some difficulty to send money in your currency and there also need some time to make steps to send money.

I think it will take considerable time until our exchange reaches you. I hope to have your every issue without interruption.

Now I am Pig-iron Pete but wish you will be fair-judge. I remain thanking you for kind advice.

Shiro Imazu,

Yokohama, Japan

Working for the Government

Editor's note: The letter following was sent by W. H. Helmerick III, vice president, to the employees of Helmerick & Payne, Inc. It gives an excellent picture of the time and energy that go to taxes. Each man can decide whether the cost is too great.

The first dollar you could call your own, out of all the money you have earned this year, was in your pay on May 19th. Up to that day the average American has been working to pay this year's taxes.

Never before have Americans had to work so long to pay their taxes. Out of each hour worked, 23 minutes' pay is taken by the Government in direct and hidden imposts.

We are reminded by the tax experts of this happy day. They advocate its observance as the first day of the year in which a man can call his earnings his own.

Last year even Congress recognized the occasion by adopting a resolution providing that it "be symbolized as a day of relief throughout the land, with such demonstrations as may seem appropriate, including a prayer for deliverance". Last year, local, state and Federal taxes took 32 cents out of each dollar the average American earned. This year the over-all tax load takes 38 cents.

In 1920, Americans began working for themselves on February 26th for the first time that year. By 1940, the date had advanced to March 27. In 1951 the tax freedom holiday was observed on April 28th. This year it is pushed up to May 19th.

Let's do what we can to push it back in '53. *W. H. Helmerick,III,*

Helmerick & Payne, Inc.
Tulsa, Oklahoma

You Are My Necessity

To The Petroleum Engineer:

In the future, should I overlook my subscription to *The Petroleum Engineer*, please bill me or my home.

I find something I need in every issue.

J. E. Patterson,

The Texas Company
Brownwood. Texas

THE NEW BEAVER "55" UNIVERSAL NIPPLE CHUCK

Simple! Easy! Best for Use With Pipe Machines, Power Drives or Bench Vises!

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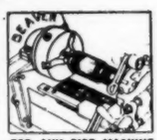

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USE WITH ANY PIPE VISE

USE WITH ANY MACHINIST'S VISE

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• Efficient
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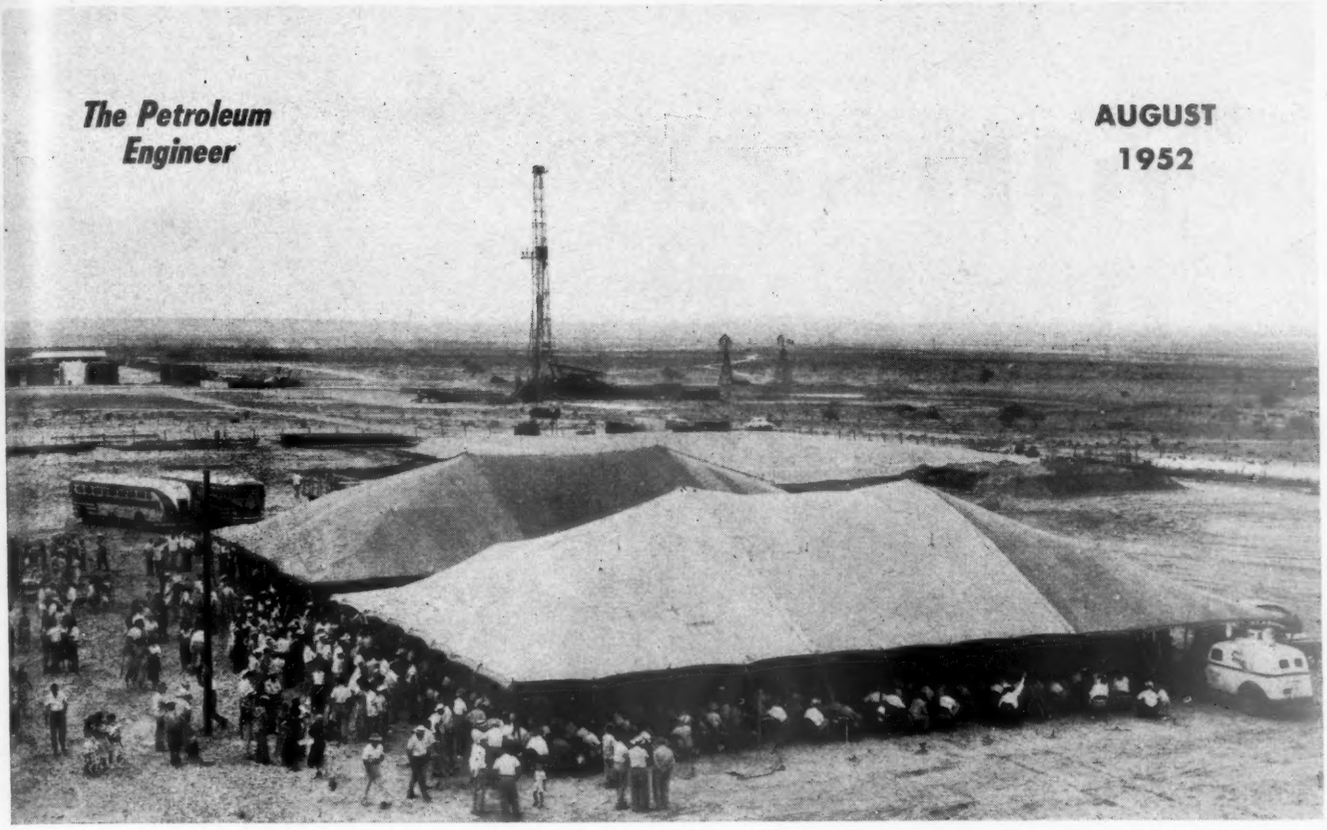
The Petroleum Engineer

AUGUST 1952



View from the McElroy-Wilshire gasoline plant shows the crowd gathered under tents listening to speakers. Buses brought guests from Midland and Odessa. Twin windmills are overshadowed by drilling rig. Dust obscures derricks on horizon.

Operators Pull Fast One to Save Gas

West Texas and petroleum companies celebrate prompt action in setting up gasoline plant for new oil field

ERNESTINE ADAMS*

It was like a Fourth of July celebration. There were U. S. flags and band music, speeches and prayers, and chuck wagon lunch and a general air of holiday. Instead of a fireworks display, a shining new gasoline plant rose from the flat mesquite-covered West Texas Plains. The only other thing in sight was a scattering of oil derricks along the southwest horizon.

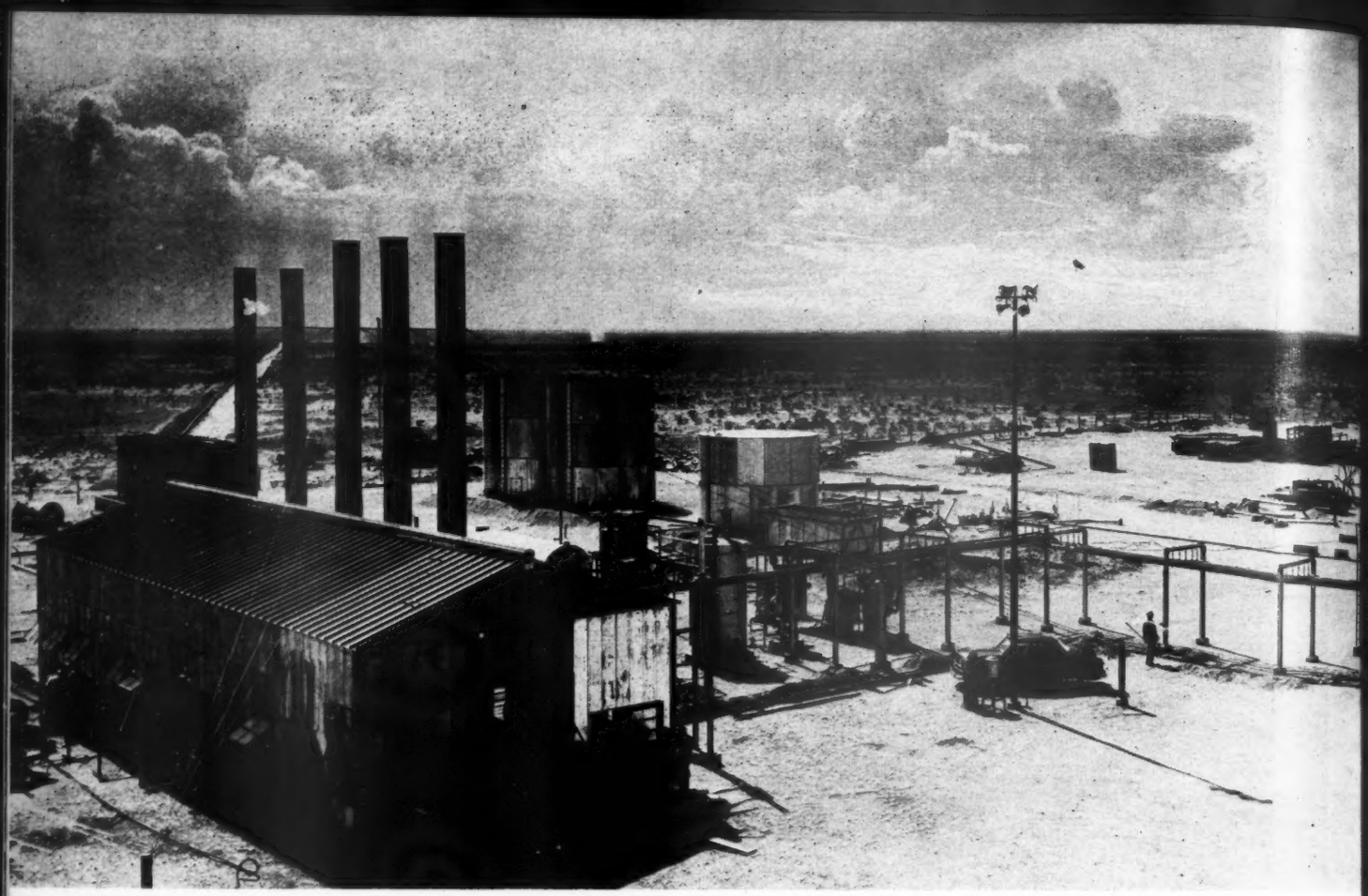
The occasion was the dedication on July 19 of the McElroy-Wilshire gasoline plant, built and operated by Lone Star Producing Company and owned by it and by Wilshire Oil Company, Inc. The plant is processing casinghead gas from the Wilshire-Ellenburger field in Upton County.

The dedication ceremonies took on the atmosphere of Independence Day for good reason. Instead of waiting for

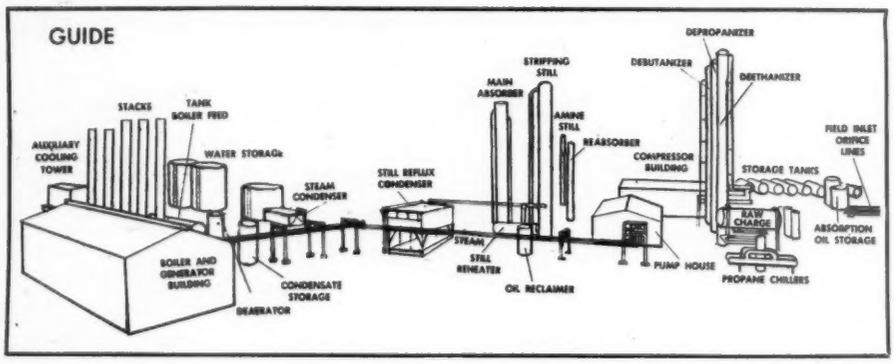
*Managing Editor.

EXCLUSIVE

Visitors to dedication park cars on the McElroy lease.



The McElroy-Wilshire plant, moved from Leeray, was installed on West Texas plains



Texas conservation laws to catch up with them, these members of the free and independent oil and gas industry of the United States had set a precedent for fast-moving conservation. Gas from the field would not be burned for safety's sake but would be utilized when it was produced with the oil.

Said the principal speaker, Olin Culberson,* chairman of the Texas Railroad Commission, the state's regulatory body, "I am happy that the Commission's only part in the McElroy-Wilshire plant was to be invited to take part in its dedication. It's a lot more fun and it's a lot healthier situation than for the Commission to order the plant to be built."

A crowd of more than 2400 persons gathered under the two big tents set up between the oil field and the gasoline plant, far from any town. There were some from New York and California, some from Crane (12 miles away) and Odessa (37 miles away), from Midland, Dallas, and from nearby ranches and farms.

If that number surprises you, it also surprised the Odessa Chuck Wagon Gang, which after the speaking heaped 2463 plates with beef barbecue, ranch beans, potato salad, olives, celery, and such. The serving project took 45 minutes, just to give you an idea of how quickly the well organized "Gang" works.

The ceremonies began at 11 a.m. with the Odessa school band, in jeans and fancy cowboy shirts, proving that there is plenty of pep in "Star Spangled Banner" if you know how to go after it.

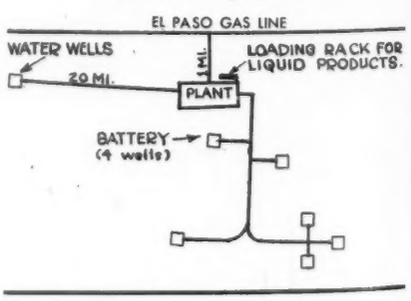
Then L. T. Potter, vice president of Lone Star Gas Company (Lone Star Producing is an associate company) and master of ceremonies, introduced distinguished guests and the speakers. Judge Culberson told of the new plant's capacity and purpose of conserving valuable natural gas, which in earlier days might have been flared and wasted; D. A. Hulcy, Dallas, president of Lone Star and board chairman of the U. S. Chamber of Commerce, recounted the essential place of capital in the free enterprise system; Donald N. McDonnell, New York, executive vice president and acting chairman of the board of Wilshire Oil Company, pointed out that the Wilshire field and the gasoline plant were a tribute to the rights and privileges we enjoy under the great American economic system.

The microphone supported the speakers' voices against the rushing voice of the plant's compressors and engines and against wind which was at first frustrated in stirring up the sprinkled dust but not for long.

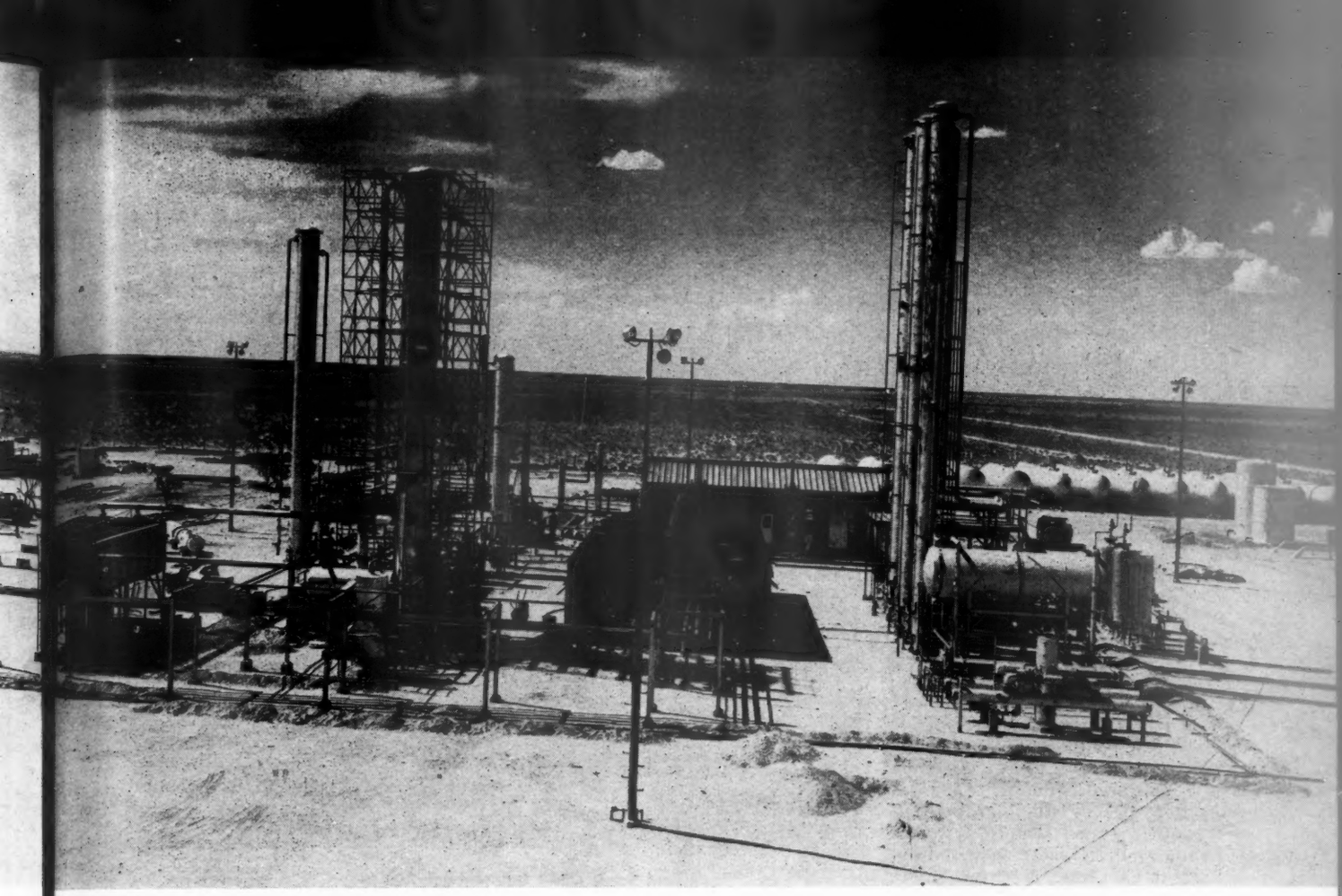
The audience listened attentively as if each one in it was interested in this chapter in the petroleum industry.

The story began in April, 1951, when Sinclair Oil and Gas Company brought

Scheme of operation.



*The following Saturday the electorate of Texas gave Olin Culberson a decisive vote of confidence by re-electing him for another six-year term.



rocess raw casinghead gas from the Wilshire-Ellenburger deep field in Upton County.

in the discovery well of the Wilshire-Ellenburger oil field in the relatively unexplored southern portion of the Midland Basin.*

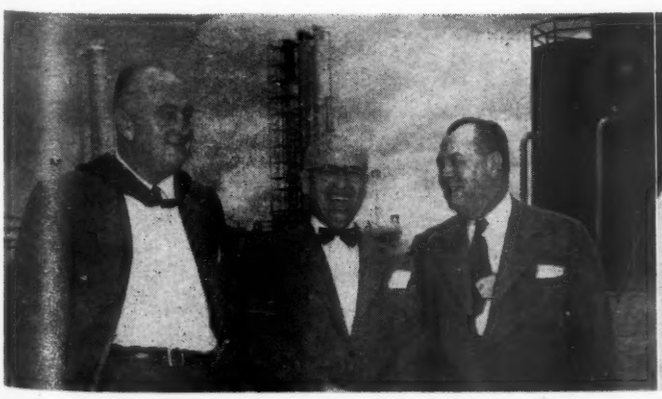
Wilshire, a California Company, which had already drilled a dry hole in the area, and Standard of Texas held leases affected by the discovery. All three companies began drilling to find out just what they had. The reservoir was below 12,000 ft and it meant costly deep drilling but the oil sand was more than 500 ft thick and potential production has run as high as 4000 bbl a day for some wells.

*See "Preliminary Geological and Engineering Data, Wilshire-Ellenburger Field, Southwest Texas," Myles A. Colligan and O. H. Berry, Jr., The Petroleum Engineer, February, 1952, Page B-7.

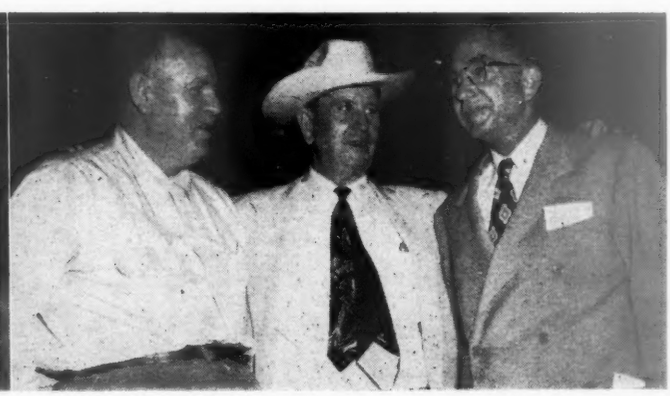
In October of the same year, when the field had only three wells, Wilshire executives, which included Frank W. Lake, vice president in charge of Texas operations, and O. H. Berry, Jr., district petroleum engineer, began looking for someone to install a gasoline plant to use the raw casinghead gas from the field. Instead of waiting the two or three years often required for a field to develop, Wilshire wanted the processing plant ready and waiting to take the gas of the wells then drilling.

This was easier decided than done. Although it was before the steel strike, materials for a gasoline plant were limited and it looked as if Wilshire would have to get in line. Then Lone Star Producing Company came up with an idea. It had a gasoline plant at Leeray, Stephens County, which was practically new, having been installed about three years ago. The gas processed there could be shuttled to another plant and the Leeray plant could be moved to the McElroy lease, some 265 miles further west. An agreement was made by which Lone Star and Wilshire each became half owner and the former was to install and operate the plant.

By January the $1,500,000 plant was being dismantled and each piece numbered for the move; the site was being cleared on the McElroy ranch for its reception. February 11 the caravan began. It took 85 loads, running as high as 59,000 lb in big tandem trailers to carry the plant from South Stephens



Smiling into the Texas wind are Wilshire's Vice President McDonnell, Judge Culberson of Texas Railroad Commission and President D. A. Hulcy of Lone Star.



Under the tent stand J. M. Kindle, Lone Star superintendent of gasoline plants, Will Odam, consultant engineer, and Ray C. Shibe, Wilshire secretary-treasurer.

There were speeches and band music. Below is the Odessa school band. L. T. Potter is at the mike and seated back of him are: D. A. Hulcy, A. W. Breeland, E. F. Smith, Marshall Newcombe, Lone Star general counsel, Julian Foster, Lone Star superintendent of transmission division, and Donald N. McDonnell.

County to Upton County. J. A. Bates and W. A. Robinson of Lone Star had charge of the giant moving job. Bates, J. F. Francis, H. H. Saunders, and J. O. Simpson handled the construction job.

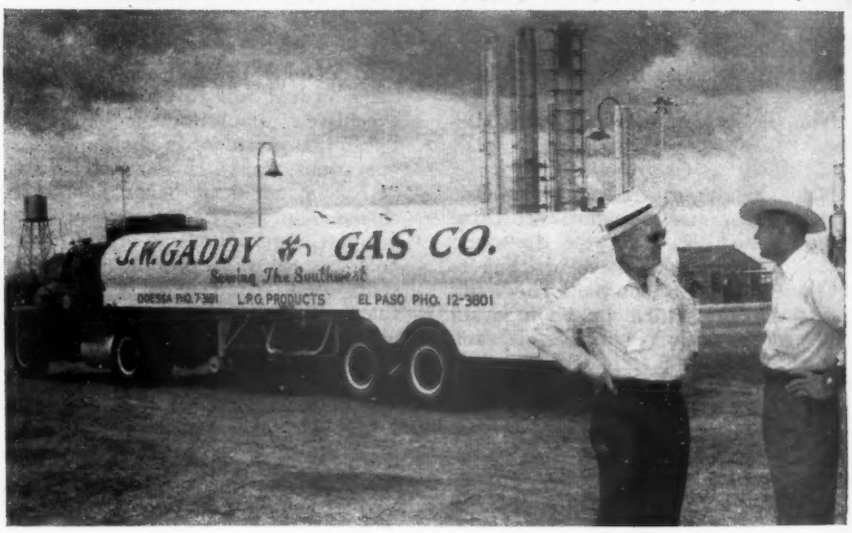
Exactly five months from the time the first load started from Leeray, gas from the new Wilshire-Ellenburger field was being processed by the McElroy-Wilshire plant in Upton County. It was a spectacular job and nothing had been sacrificed to gain time. A perfect safety record was held representing 50,000 man hours without a disabling injury. In the ceremonies, Superintendent Francis received a safety certificate from A. W. Breeland, Lone Star assistant director of personnel, for this record of "conservation of our most important resource—manpower."

There was more to it than just setting up a plant.

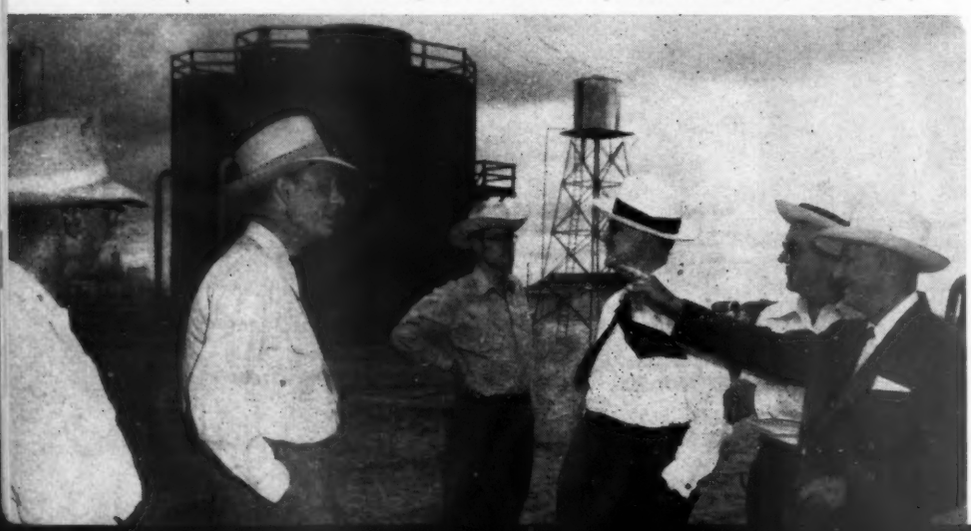
An analysis of the water beneath the plant site showed that treatment for use would be more expensive than going 20 miles northwest of the plant, drilling for water in the sand hills, and piping it back to the plant.

The 20-mile right-of-way to the 18 water wells was dubbed "Nightmare Alley" by the crews, who fought dust and cacti and lizards to lay the 4-in., 4½-in., and 6-in. pipe that carries 70 gal of water a minute now and will have more pumped through later. The

Paul Bagley, left below, Lone Star gasoline sales manager, made the contract with J. W. Gaddy Gas Company to buy LPG output of the plant.



E. F. Schmidt, right, senior vice president, is pointing out a tower to Lone Star men: Cecil Louks, left, Bronte plant superintendent; T. S. Bacon, chief engineer, an unnamed visitor, W. G. Wiegel, treasurer and personnel director, Paul Bagley.



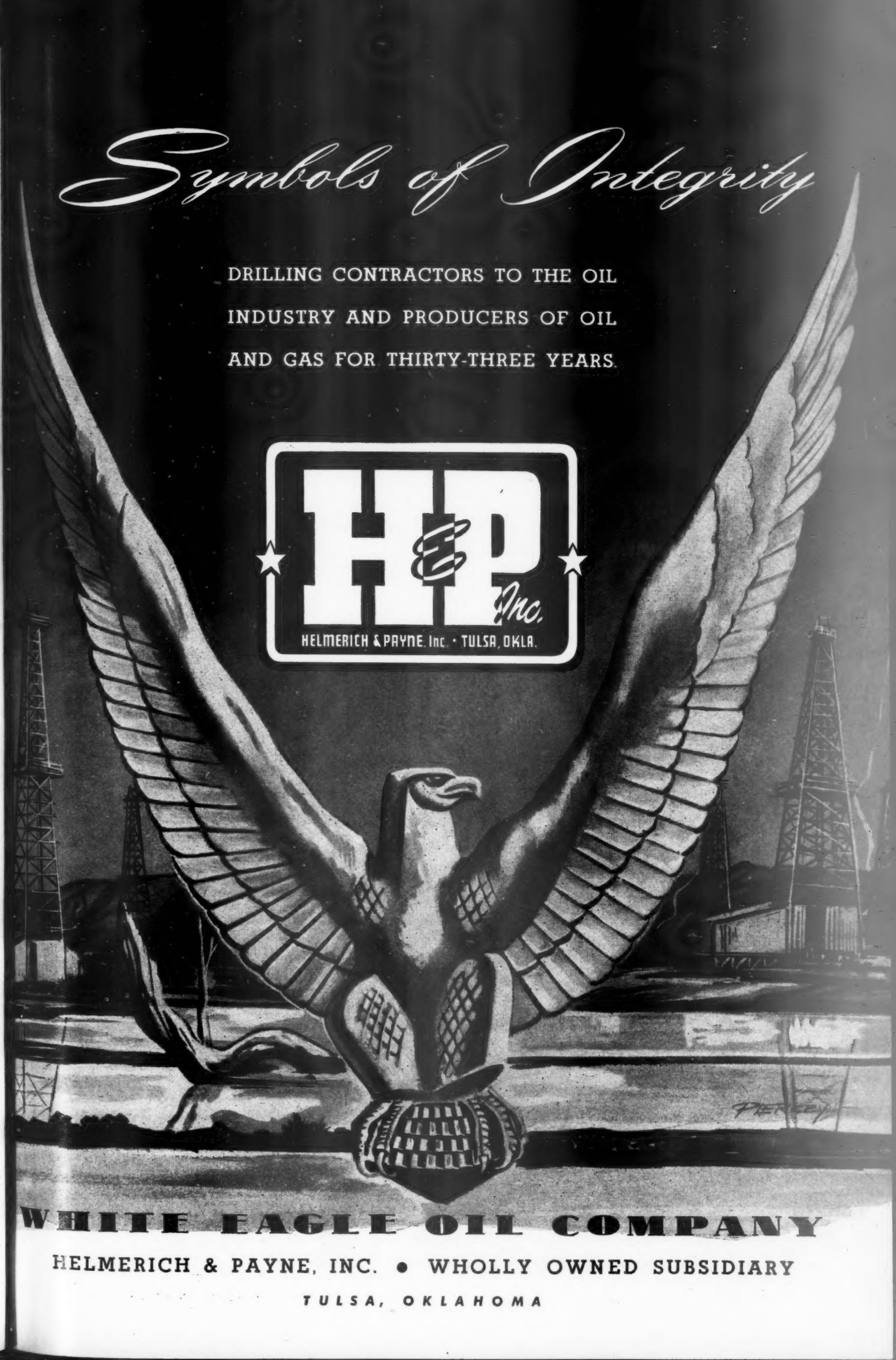
air-cooling systems in the plant for exhaust steam, engine water, and compressor gas reduce the water requirements.

Cost of the water system was about $250,000.

W. J. van Bibber of Lone Star was in charge of constructing both water- and gas-gathering system, which were under contract to Smith and Lingle.

The gas-gathering system goes south and in 10 miles of 2-in. to 10-in. lines tie in six batteries of four wells each. These are Wilshire and Sinclair wells. None of the Standard of Texas wells are tied in now. There are 30 producing wells in the field and 11 drilling rigs are operating.

When the plant began processing 5,000,000 cu ft of gas to recover 17,000 gal of liquid hydrocarbons a day it al-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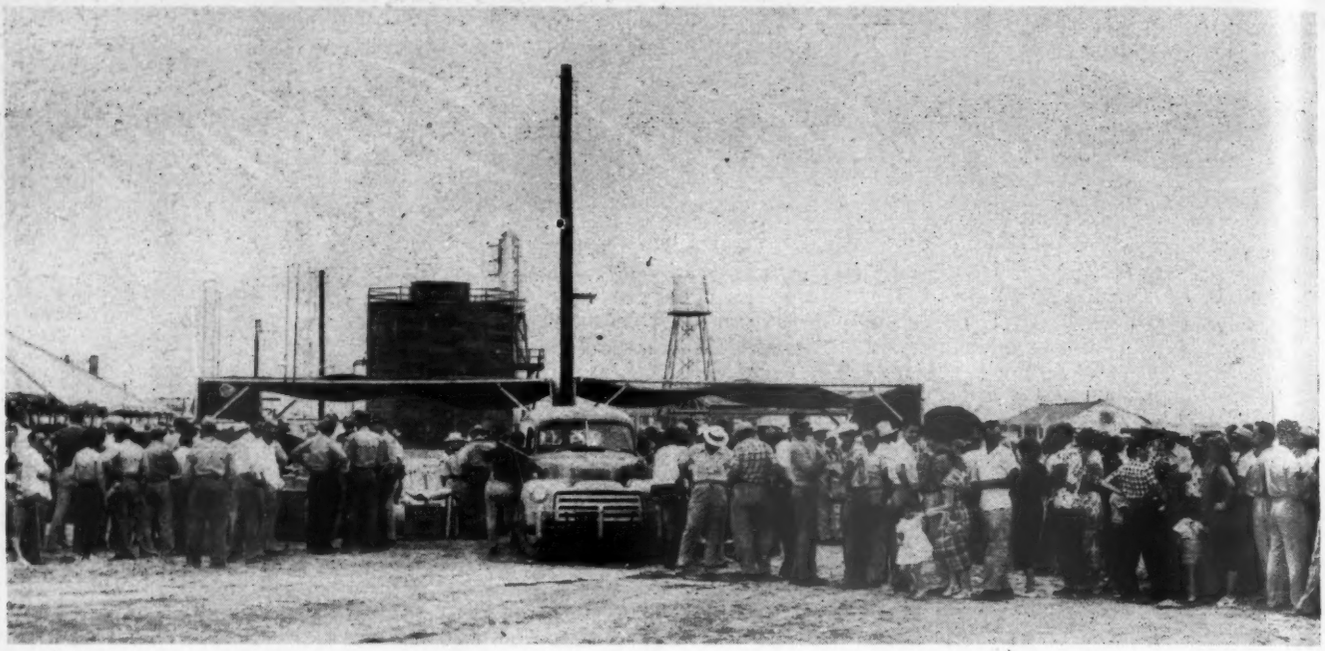


Lined up for chuck wagon lunch are the guests at the dedication. Tents are on the right; gasoline plant in the background.

ready had a capacity of 16,000,000 cu ft of gas a day with production of 30,000 gal of natural gasoline, butane, and propane. It will be possible to double the capacity by adding to the three 300-hp compressors.

A gasoline plant saving casinghead gas is all very well but there has to be a payoff. That is why the plant was built only a mile from the El Paso Natural Gas Company transmission system extending from the Permian Basin in Texas to California. El Paso Natural buys the dry gas after it had been processed.

G. W. Gaddy of Odessa has contracted for the liquid petroleum products and will transport the natural gasoline, butane, and propane in huge trucks to be sold in his West Texas distributing area.

So first an oil field was discovered and then a plant was moved and good water found and — how important! — customers obtained. Now the oil can be produced and the gas sold to the plant. The plant processes it and sells the LPG and dry gas to distributors who in turn supply their customers with products. The entire process is based on the gas by-product that for a time would have been flared in the West Texas wind.

It is estimated that 12 billion cubic feet of gas were saved by the prompt action of Wilshire and Lone Star — enough gas to supply a city the size of Colorado City, Texas, for 60 years and enough liquid petroleum products to supply more than 50,000 ranchers and farmers for a year.

That is the significance of the big dedication ceremonies but it does not tell the whole story.

Why did officials of Wilshire and Lone Star invite their employees and friends, local Desk and Derrick members, and the people of the community to a celebration and open house? Why did the executives of the companies make long trips to attend? "Never saw so much Lone Star brass together in my life," said a Lone Star employee. Most of them made an overnight train trip on the Texas and Pacific to be there Saturday and went back that night.

It wasn't because either company has local customers because they don't. Lone Star's nearest gas distributing area is Colorado City. Wilshire sells its oil to refineries.

Why did so many people of the community drive long miles on a hot, dusty day over washboard roads to listen to speeches and look at what must have appeared to most as mysterious machinery?

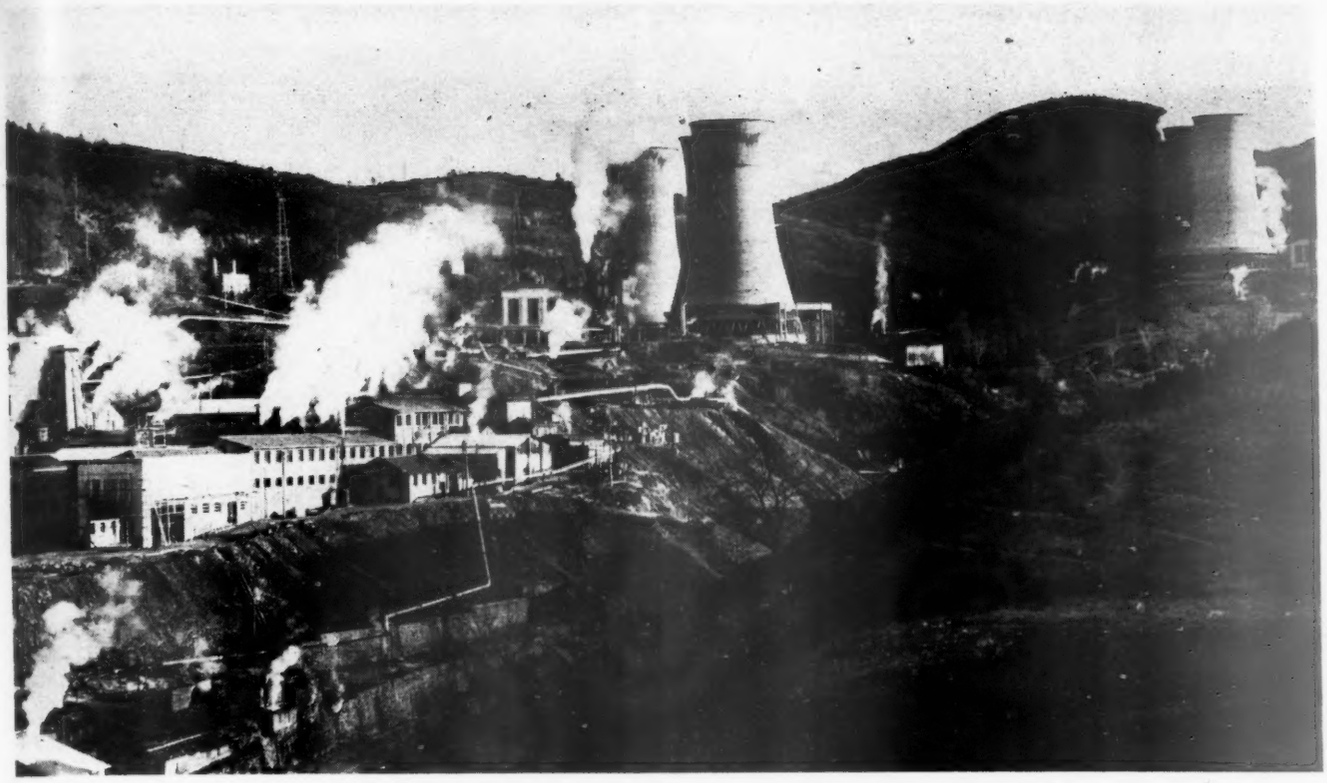
Why did 2643 persons take great interest and pleasure in the dedication of a gasoline plant?

There are many diverse reasons—the pride of the companies in their achievement, the pride of the Texas Railroad Commission in this evidence of the progress of the oil and gas conservation they work toward, the pride of the distant towns in a new project for the area, the special camaraderie that exists between the members of the oil and gas industry and friendly West Texans.

All these reasons resolve into a symbol of a new spirit of interest and understanding between the petroleum industry and the U. S. consumer of its products. Part of this is created by the dedication of processing plants dotted over the nation and of pipe lines that supply them and then carry their products to the centers of population.

The McElroy-Wilshire plant was set up for the best kind of conservation—conservation for use—and it was dedicated to the ruler of our economic life—the U. S. consumer. * * *

Arriving from Dallas or meeting the train early Saturday morning were Lone Star's Ernest Sneed, W. G. Nash (with brief case), Bruce Cunningham, Carl Hill, T. J. Uhl, and E. F. Schmidt, talking to Ernestine Adams, *The Petroleum Engineer*, and Claribel Thompson, editor of Lone Star *Blue Blaze*.



The development at Larderello, with its large chemical plant and power station, operates on underground steam generated by volcanic heat. Although steam is plentiful, water is scarce, hence the need for the large natural draft cooling towers at the right.

Societa Larderello in Italy Brings in World's Largest Steam Well

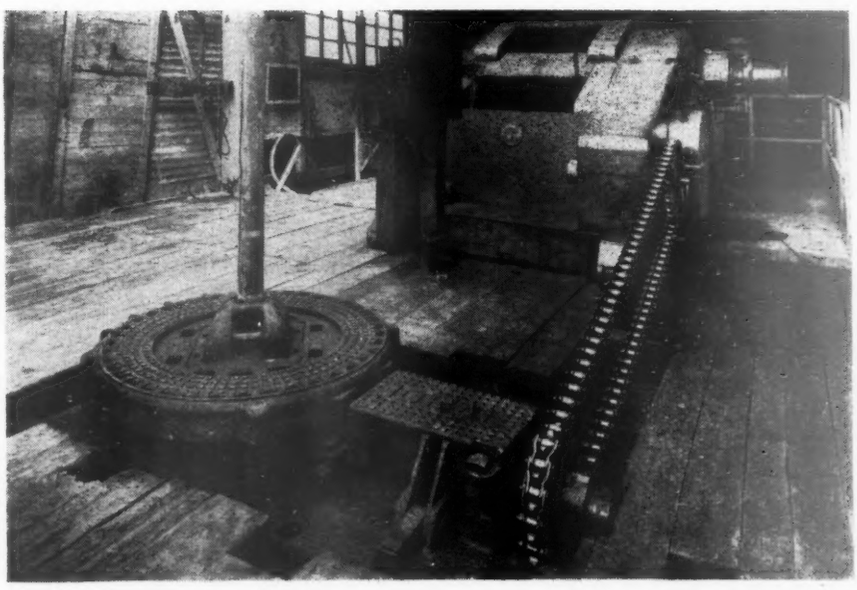
Rotary drilling rigs develop country's power facilities

ALFREDO MAZZONI

MODERN rotary drilling rigs are now helping the Societa Larderello in Italy tap its underground steam supply to expand its power facilities and provide steam entrained chemicals for industry. Its largest well, and the world's largest, was brought in on July 16, 1951 with a Ideal Type T-16 (now the T-20) drill rig*. The well, No. 82, has a flowing capacity of 660,000 lb per hr at 100 psia and 437 F.

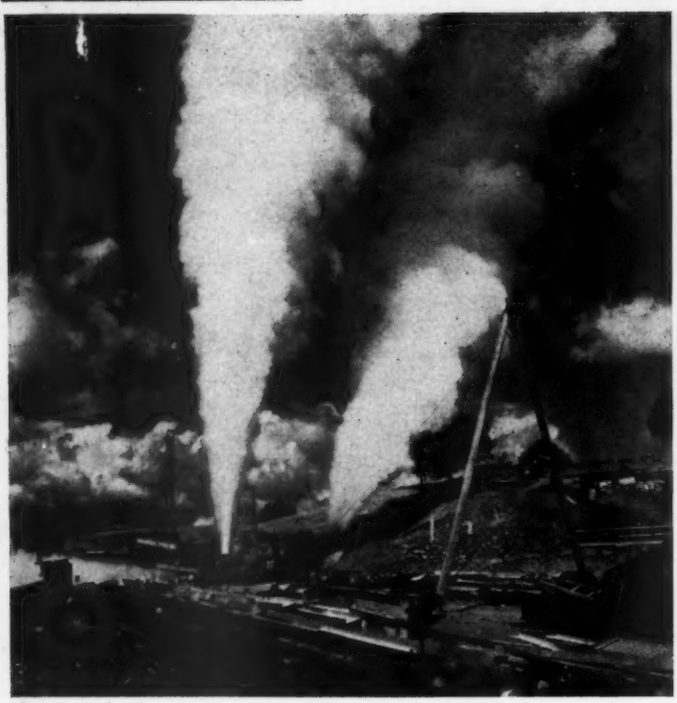
The development at Larderello is situated in the center of a 77 sq mile area in Tuscany overlaying an unlimited

*National Supply Company.



Rotary table and drawworks of National Supply Ideal Type T-16 drilling rig used to drill the Larderello steam well No. 82. It is able to drill to depths of 2000 to 4000 ft.

Italian Steam Well



With derrick and drawworks removed, well No. 82 is permitted to blow freely until pipe lines can be run to connect it to the feeder system.

The largest steam well in the world has a flowing capacity of 660,000 lb per hr at 100 psia and 437 F. It was brought in July 16, 1951.

The Author

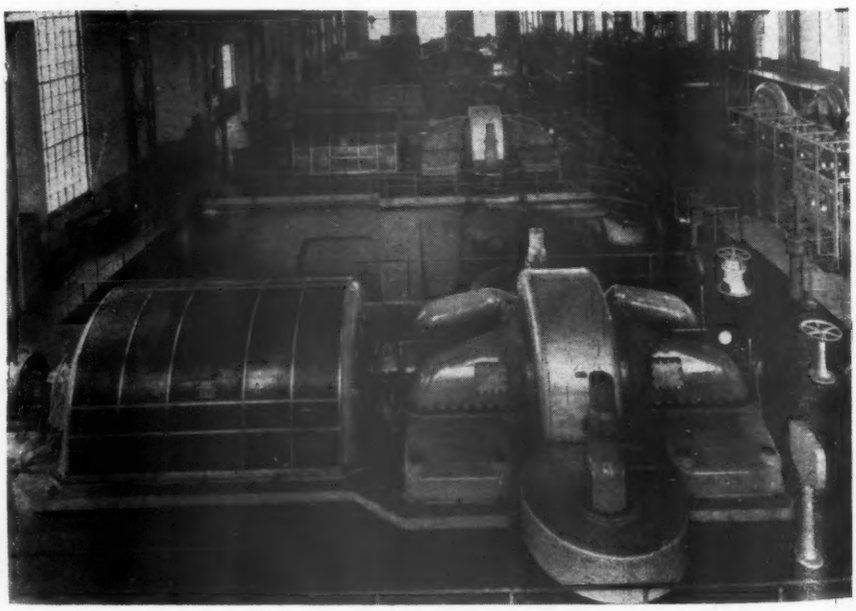
Alfredo Mazonni has been manager of the Societa Larderello in Italy since 1946, where he has been active in rebuilding the plants damaged in the war. Supervisor of the Larderello power station No. 3, he has been instrumental in formulating plans for intensive drilling of steam wells. He was born in Bologna, Italy, and obtained his electrical engineering degree at the Polytechnic Institute of Turin in industrial electrotechnical engineering. After a period of apprenticeship with AEG Tomson Houston of Milan, he directed the 3000-v d-c electrification of the northern and central Italian railway lines and supervised construction of the Bressanone (Alto Adige) hydroelectric plant.

supply of underground steam, which issues from the ground in some places through natural openings called "fumaroles." Actual source of the steam is unknown, but recent studies indicate it may come from the molten magma in the freezing stage; perhaps originating from the crystallization water that is freed from the solidifying magma. It is known, however, that the steam is generated at high pressure and rises in considerable volume through clefts and faults to within 20 to 26,000 ft of the earth's surface. In other instances it diffuses through porous sections of the earth to the surface.

The natural phenomenon of the steam vents and "lagoni" in Tuscany has been observed for centuries: Lucrazio Caro who lived during the first century B. C. mentioned it in his poem "De Rerum natura". But it was not until 1777 that Francesco Hoefer, a chemist who was drug manager at the Court of the Granduca di Toscana, discovered the presence of boric acid in the boiling water of the "lagoni" and realized the possibilities of industrial development. The source of the boric acid is unknown, although it has been suggested that some underground substance breaks down under the action of steam to form the acid, which is carried along by the steam. No one has been able to prove, however, that such substances exist in the deep underground formations.

Credit for beginning the first prosperous boric-acid industry goes to Francesco Larderel who, in 1818, conceived the idea of using the steam to concentrate the boric-acid solution from the artificial "lagoni". But no attempt was made to use the steam for power generation until 1904, when Prince Piero Ginori Conti, overcoming great construction difficulties at the time, suc-

Larderello power station No. 3, largest on the system, contains four 30,000-kva turbine generators operating on 68 psia and 437 F steam and generating at 10,500 volts and 50 cycles. Compressors at right remove carbon dioxide from condensing steam and compress it for use in the chemical works.



ceeded in operating a steam engine driven dynamo to light five electric lamps.

From then on, progress in the use of the steam for power was rapid: In 1905 a 40-hp steam engine driven generator was installed, in 1913 a 250-kw turbine generator and in 1941 three 1250-kw turbine generators were added. Today the seven Larderello power stations have an installed capacity of 262,000 kw, and daily production exceeds 5,000,000 kw hr. Last year the system generated about 1,600 million kilowatt hours, and this year it is expected to reach two billions. This is 7.5 per cent of the total Italian power production.

One of the plants, the Larderello No. 3, erected after the close of World War II, is the largest geo-thermic station in the world. It has four 30,000-kva, 10,500-v, 50-cycle turbine generators operating on natural steam at 68 psia and 437 F. Steam consumption is about 21 lb per kilowatt hour. At 85 to 90 per cent power factor, rated output of each unit is 26,000 kw, giving the station a daily continuous output of 2,500,000 kw hr. Larderello power, with that from other stations in the same zone, feeds a 120-kv network from which two-thirds of the electricity goes to supply the State Railways System, with the remainder going to the regions of Tuscany and Lazio.

Scarcity of water in the region requires that condensing water for the turbines be conserved to the utmost. Condensers for the Larderello units, each requiring 424,000 cu ft of water per hour, operate on a closed circuit with concrete hyperbolic shaped cooling towers. Water enters at 113 to 122 F and returns to the condensers at 77 to 86 F with outside ambient temperature of 77 and humidity of 60 per cent.

Carbon dioxide contained in the steam (about 5 per cent by weight) is removed at the condensers and compressed by eight 1300-hp, 4500-rpm compressors which produce 12,300 lb of carbon dioxide per hour.

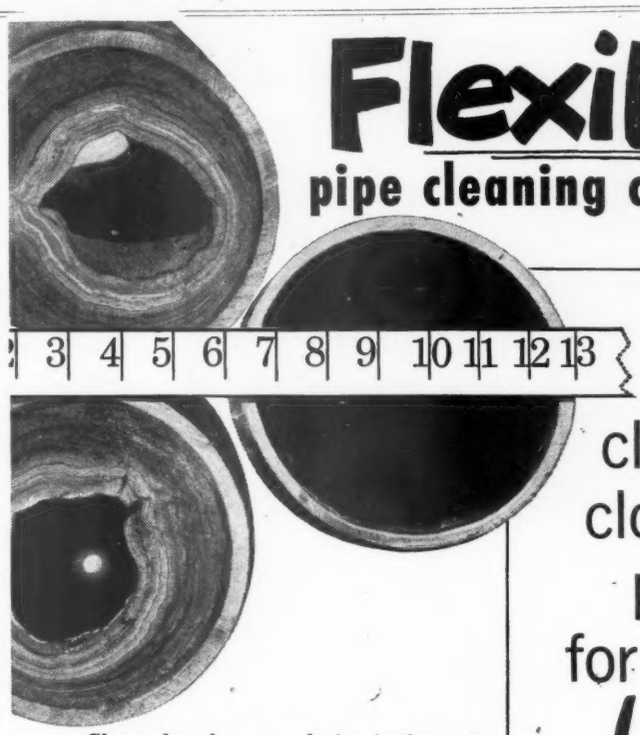
During the early development of the Larderello area, steam issuing from the natural openings was collected by building large brick domes over the exits and connecting them to pipe lines. This crude method gave a very limited amount of steam and a search was begun to find a larger source by drilling. Sucess with small wells soon led to using larger and larger drills to get greater quantities of steam. Today the modern rotary rig, with drilling bits as large as 23 in. in diameter, is bringing in wells that flow from 220,000 lb per hr up.

Drilling in the Larderello zone is more difficult than the usual drilling for oil because the drilling bits are larger, the formations vary from soft to very hard and the strata have steep dips. This leads to deviation of the hole, heavy stresses in the drill string, and sometimes stuck bits. Furthermore, the ground heat in spots (437 F) raises the drilling mud to temperatures of 195 to 200 F, which introduces serious viscosity problems. As with drilling for oil or gas, uncertainties are generally present; quantity and quality of steam depend on hitting a fracture or zone in the earth directly connected with the producing area.

Aside from boric acid and carbon dioxide, the steam also contains hydrogen sulfide and ammonia. The ammonia is combined with carbon dioxide to make ammonium carbonate, a product used in the candy industry. Boric acid, either pure or made into borax, is used in many fields such as ceramics, glass and enamel, and boron carbide finds many industrial uses. Boric acid production at Larderello is the only one on the European Continent, and one of the very few in the world. * * *

World Oil Supply Rises

Through technological progress, world production of oil has reached an all-time high of 12,000,000 bbl a day, of which the U. S. produces more than half. A prominent oil industry research director has called this achievement in the face of a "limited war" perhaps the most outstanding industrial achievement of 1951. Proved reserves underground were greater in 1951 than 1950.



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You, no doubt, are considering *replacing* this clogged pipe. But before you consider pipe replacement, remember this – Flexible Pipe Cleaning Company can *clean* that clogged line – return it to guaranteed 95% efficiency – and AT A FRACTION OF REPLACEMENT COST! For example, new 10" steel line, 30" underground costs at least $6.00 per foot wrapped and laid. Tees and crosses are extra. Flexible can *clean* that SAME LINE FOR ABOUT 18¢ PER FOOT – *or 1/30th the cost of replacement!*

How much to clean your clogged lines? Send for our Preliminary Job Cost Estimate form. Take five minutes to complete this form and return it to us. We'll give you a free estimate on the cost of cleaning your pipe – stacked, stored or underground. Our crews are near you.

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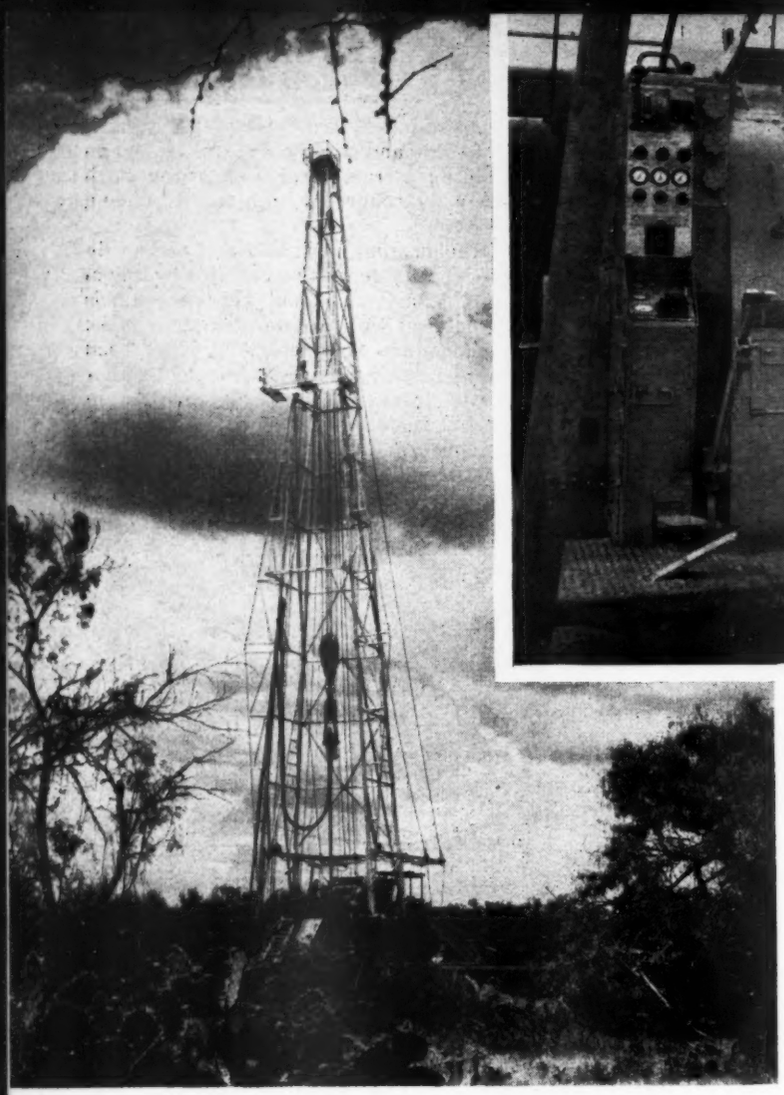

The newest "Oilwell" rig is a compact design, adaptable to two or three engines and one or two pump drives. Either a straight mechanical drive or torque converters can be used. The three-speed draw works shown is driven by three torque-converter-equipped engines. When furnished as a Model 66 with mechanical drive, it has six forward and two reverse speeds. Capacity is for depths of 4500 to 7500 ft. At left is one drilling near Victoria, Texas, Gulf Coast area. Above is a close-up of the draw works of Model 63-T rig.

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If You're a Business

How to Reach 90 Years

"Oilwell" staff reveals some secrets of its longevity that every business should know

ERNESTINE ADAMS

You can learn a lot in 90 years and "Oilwell's" brief pause to acknowledge its venerable age proved the company has learned one thing—it is fine to have respect for your past but thought and effort belong to the present and the future. Oil Well Supply celebrates its distinguished anniversary with assurance of one receiving an earned degree.

The question often asked on such occasions—"To what do you attribute the growth and success of 'Oilwell'?"—was put to some executives at the Dallas headquarters. After all, hundreds of men in the early 1860's were setting up shops to supply the infant oil industry. What was there about John Eaton's oil field supply business, which began selling supplies to drillers in 1862, to make it outlast them all? What is the secret of this firm in a venturesome business that it can reach the astonishing age of 90 years when there are few firms, in either speculative or conservative lines, that have managed to remain so long in the fast-moving U. S. economic scene?

This was no careful survey, with answers balanced and analyzed, but the impromptu replies are worth anybody's consideration, whether he is in the oil industry supply business or not—that is, if he'd like to see his own company reach its 90th anniversary with a great reserve of vigor and vision for future growth.

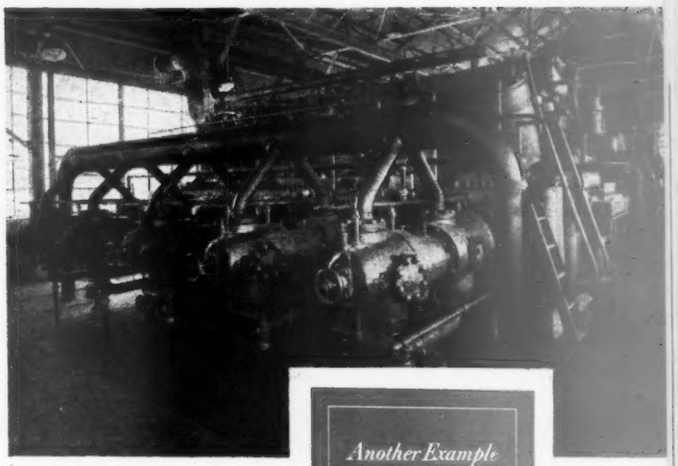
EXCLUSIVE

Specialization

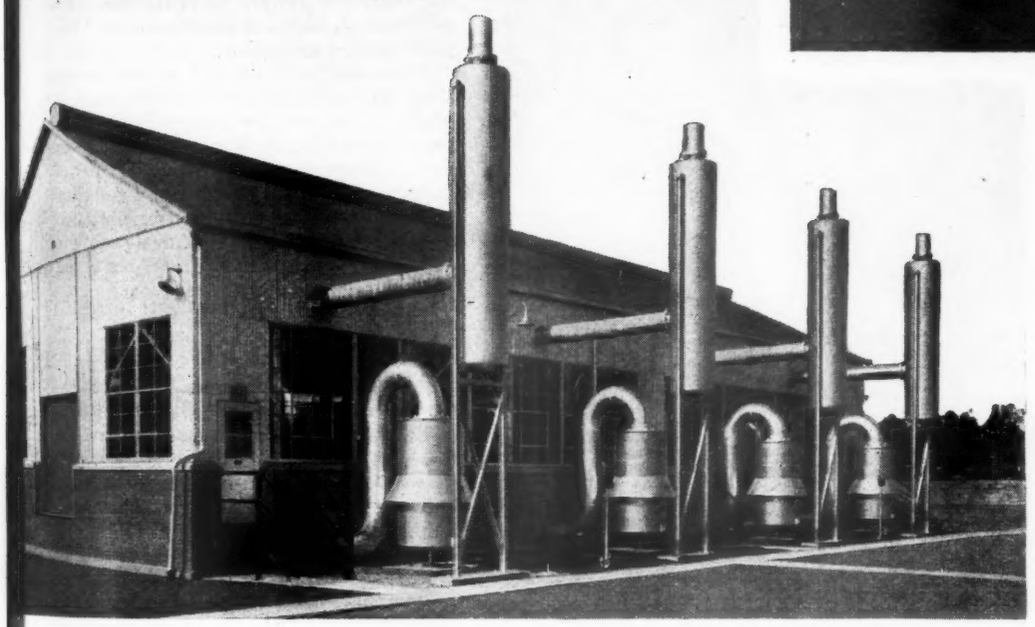
Specialization was the first item named as the secret of "Oilwell's" seniority in the supply business. In all its 90 years, the first concern of the company was to supply the oil industry and the oil industry alone. Originally Eaton

In Oklahoma Natural's largest gas-storage project . .

. . a lot of compressing in small space with compact GMV's



Another Example of Efficient Power at Lower Cost



Look at the size of the building . . . and the neat compactness of this 4400-hp GMV compressor set-up. Here, at Depew, Oklahoma Natural Gas Company is equipped to handle approximately 160,000,000 feet per day with a suction pressure of 500# and a minimum injection pressure of 800#—a lot of compressor work with a minimum of installation and operating overhead.

Note also that these Cooper-Bessemer V-angles are driving 5 compressor cylinders per unit . . . in other words, a compressor cylinder for every crankthrow.

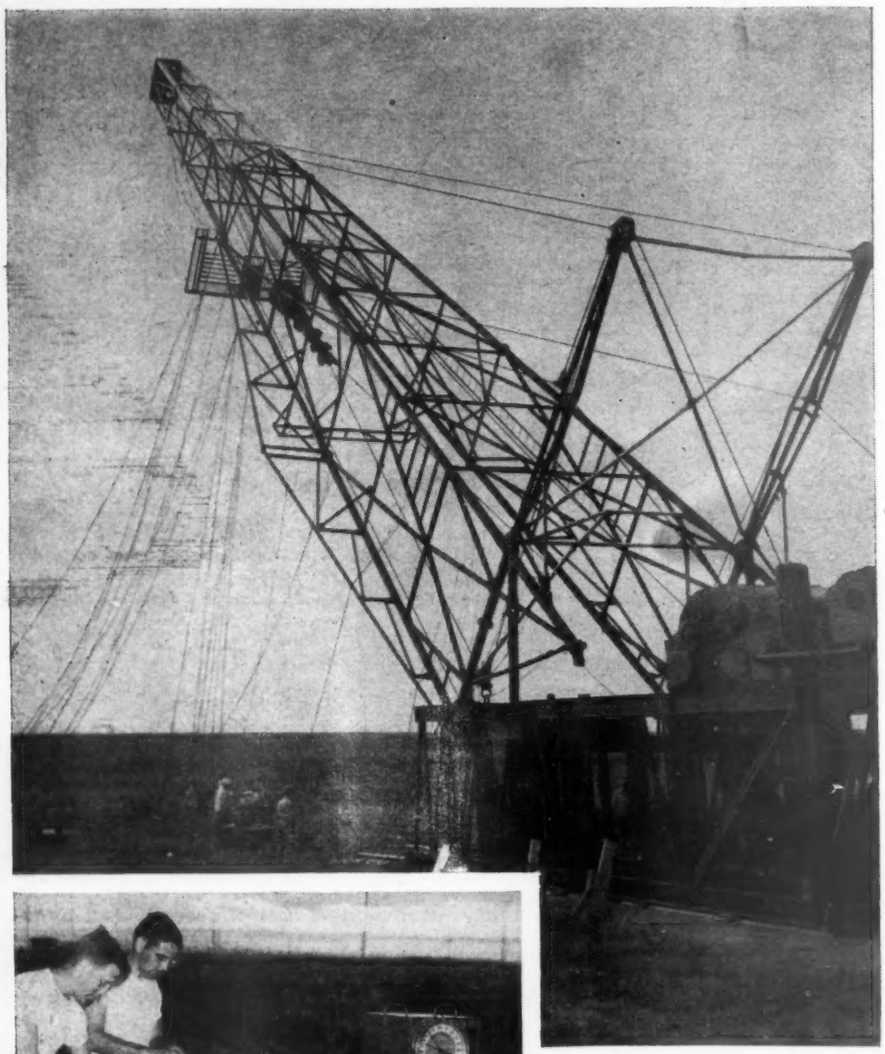
Add up the advantages you stand to gain with Cooper-Bessemer V-angles—proved month-in-month-out availability, unmatched compactness, and overall operating efficiency that has yet to be equalled! Get *all* the facts. You'll see why Cooper-Bessemer V-angles are preferred units in every type of heavy-duty compressor service.

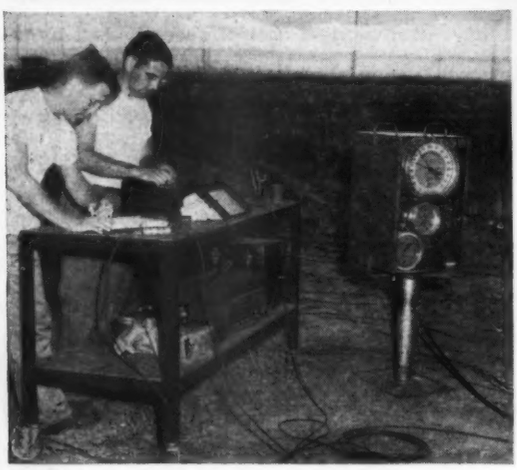
The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York City Washington, D. C. Bradford, Pa. Parkersburg, W. Va.
San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas
Seattle, Wash. Shreveport, La. St. Louis, Mo. Los Angeles, Calif.
Caracas, Venezuela Gloucester, Mass. Tulsa, Okla. New Orleans, La.

This new warehouse and modifications center at Garland, Texas, has enabled "Oilwell" to improve its service to its customers throughout the great Southwestern oil region. At left can be seen a drilling rig.





hen this portable derrick was tested in the cool hours of early morning at Garland, Texas, strain gages were attached to every part where stresses were to be measured and hooked up with weight indicator to record dead line pull. Before sunrise the temperature was 58 and test was carried through mid-90 degrees of afternoon for a wide temperature range.

made or bought equipment for the drilling and producing phase of the industry. In recent years Oil Well Supply has added refining and processing and pipe line supplies. Only during war time did the company deviate from its specialty and then it was to manufacture and deliver needed armaments.

After the oil industry moved away from the water and salt-drilling rigs, it continued to ask for heavier and more rugged machinery. Tools demanded in the industry were those that could deliver more power and withstand rougher treatment than most industries need, so oil industry equipment is designed for one market alone and rarely can it be sold to another.

Machinery for One Industry

Repressuring machinery is a good example of this specialized need. "Oilwell" is naturally proud of its part in the advancement of secondary recovery through its development of repressuring equipment. Engineering data for old fields were generally not sufficiently extensive or reliable to persuade an operator to buy the costly machinery for repressuring with any confidence in a profitable secondary recovery operation. Oil Well Supply's answer to this problem came in the early 30's when it offered for rent or sale an air-gas repressuring test unit, which could be moved into a field and tried out for 30 to 90 days to determine the feasibility of a permanent repressuring installation. Reservoir engineering has moved ahead since those days and the need for the testing unit, which once spurred secondary recovery, has passed.

"Oilwell's" modern air-gas repressuring units and water flooding units are the results of years of development. They play a significant part in the highly specialized function of secondary recovery—a phase of the oil industry that is racing new discoveries in importance.

The rotary drilling rigs recently developed by "Oilwell" represent another example of this specialization. These rigs are manufactured with a trend toward automatic controls, faster drilling, greater mobility—the qualities the oil

Portable repressuring test units of the early 30's were the forerunners of the modern "Oilwell" gas booster or compressor units. Above is a modern gas booster unit installed near Alice, Southwest Texas.

industry is looking for to cut costly time from operations.

Although some of its equipment, such as engines, may be bought by other industries, this is because it happens to fit needs outside those for which it was designed, for Oil Well Supply has concentrated for 90 years on the needs of just one industry. All the idea departments of the company—research, design, testing, engineering, and marketing—center their work on equipment needed to find and transport and process petroleum.

Organization

During its long history the company has progressed from a small organization with highly centralized control to a widespread decentralized organization of some 4000 employees. Its members feel this decentralization is a great advantage in carrying on the supply business efficiently. Broad policies and general rules are laid down by the headquarters organization. The heads of the various areas and, in turn, of the smaller districts, can make their own decisions within the general policies of the company. This has proved good both for the company, which thus saves its customers possible delays, and good for the field personnel because it is excellent training for higher executive positions.

The outcome is that the major part of the growth ideas for Oil Well Supply originate in the field. It is the salesman in a new discovery area who first estimates the possibility of a new store there. It is the district or area engineer who reports a new equipment need. In other words, the man in contact with the customer, who has wide responsibility in this decentralized organization, is the key to progress. His close association with actual operations lessens the margin of error in adding a new store or adding a new equipment item to the 60,000 plus pieces already handled.

So complex and, consequently, so expensive is modern oil equipment that "Oilwell" has instituted a system of forecasting future needs so that manufacturing and buying can be directed more specifically to demands; so that great sums of money will not be tied up in machinery that moves slowly and is in danger of becoming obsolescent.

The decentralized organization helps here. "Oilwell" people stationed in oil areas of most of the world send the information they have gained in the field to headquarters. In Dallas the reports are studied for each area and are compared with other areas to develop an overall picture of coming demands of the petroleum industry. One new item in use may affect many other pieces of equipment. For instance jet bits call for heavier pumps, etc.

"Oilwell" manufactures most of the large machinery it sells and buys most of the smaller items from specialty houses. Whether it is made or bought by the company, the knowledge gained from the field personnel is invaluable in keeping equipment on the level with operational techniques. The manufacturing schedule is based on the forecasting program, which goes on continually.

Stores

A humorist once asked what came first the oil field or the oil-field supply store. The fact is they come so close together at times that it might be hard to remember.

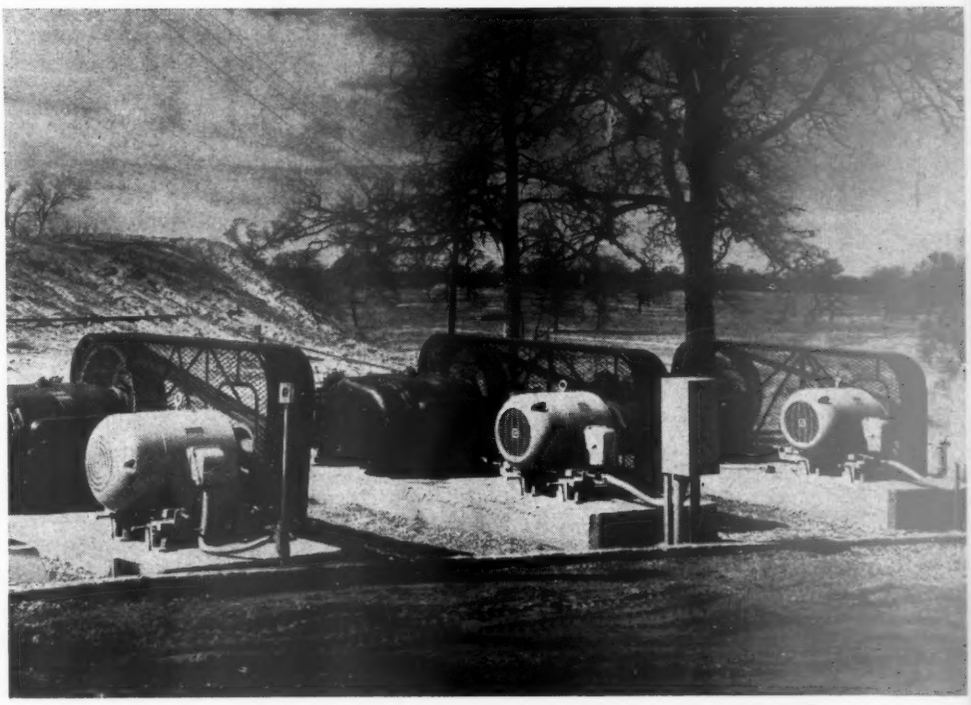
Stores in the right locations is one of the secrets of "Oilwell's" having a 90th anniversary. When equipment was some adaptation of salt or water-drilling tools it was usually custom-made close to operations. As the machinery became more specialized, Oil Well Supply began manufacturing the items it could not buy for resale. The industry spread from the East to the Mid-Continent and California and the Southwest; the supply stores followed. The stores carried whatever the oil operators needed. Success for the supply house depended on getting into a promising new location early but not into an area where the play would soon die out.

In other words the supply store had to take much the same kind of risk that the oil companies took.

"We've made mistakes, all right," one man said, "but not so many considering some of the chances we've taken."

For instance, "Oilwell" built a supply store in Clay City, Illinois, when there were about a half dozen wells. That was one of the big chances that

Secondary recovery meant water flooding as well as air-gas repressuring and "Oilwell" designed triplex horizontal power plunger pumps in the early 40's especially for water flooding. Below is an installation near Corsicana, Texas.



"Oilwell's" 94 supply stores, spread over oil and gas producing areas of the United States and Canada, have a wide architectural range. Most of the new ones are of modern style, with straight simple lines like the one shown below, which is in Ventura, California.

Others are shaded by trees that have grown since the store was built like the Oil City, Pennsylvania, supply store shown above. The first "Oilwell" store was opened in Oil City in 1867 by John Eaton and E. H. Cole. The present store at Oil City is adjacent to "Oilwell's" Imperial Works.

paid off. From the time the store opened in March until Christmas Eve of the same year the doors were never closed. People talked about being "as useless as the key to the Clay City store." It was the beginning of the Illinois oil boom.

Like an oil company, the supply company makes a detailed study of a location before it makes the large investment of a store building and ships in the machinery and parts. It must know the extent of leasing and the geology of the area and what type of formations are encountered. It must protect its position with its regular customers. If good customers are in the area, "Oilwell" is, of course, more likely to open a store.

There was a time when oil companies warehoused their own supplies wherever they operated but this grew more expensive and inefficient as equipment became more diverse and more costly. Now the supply stores function as warehouses. They have at hand almost any equipment or part. The old frustration of having to shut down a drilling well until the operator himself came up with a replacement for a broken part is unusual in these days. The risk of expensive equipment becoming obsolete in the warehouse is less for the supply house that serves many companies than it would be for the oil company providing supplies for itself but no one else.

If you think it is strange there are no supply stores in foreign lands (Canada is an exception) that is because only one company may have the concession over a whole area and under these circumstances there is no advantage in the supply store over the company warehouse. Supply companies do have sales offices in many countries where there is considerable oil activity.

There are now 94 "Oilwell" stores in the oil and gas areas of the United States including 4 in the Canadian West, all Johnny-on-the-spot to keep the drills going down and the oil coming up.

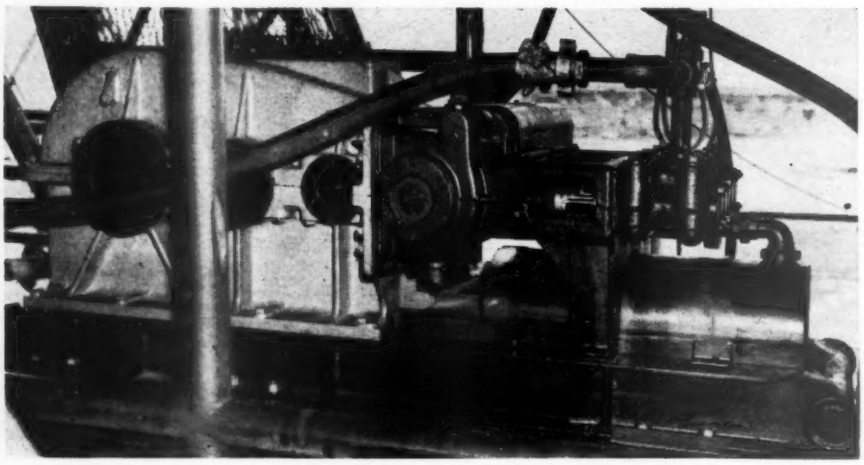
More intangible but perhaps more important for that, is the role of the supply store as the gathering place of oil men. It is to the oil industry what the country store is to the cracker box brigade. It is a place where the oil fraternity meets to swap yarns, hear oil industry gossip, and exchange information about leases and drilling and local living conditions. Every one can be found there sooner or later — from roustabout to superintendent.

An Illinois newspaper man once wrote a long poem about the boys who hung out at an "Oilwell" store, ending with:

"You may please excuse me from the
'sweet Bye and Bye'
If I don't meet the gang from the Oil
Well Supply."

Translated into general terms, one of the secrets of Oil Well Supply's sticking around so long, is that it stuck so close to its customers.

The Brantly feed control was developed by Oil Well Supply through an exclusive license with J. E. Brantly in the early 30's. At first it allowed semi-automatic feeding of the bit; late models are completely automatic.



Engineering

Service, another not-so-secret element in Oil Well Supply's 90-year-old solidarity, is largely engineering aid and, of course, interest in the problems of its customers.

"Oilwell" engineers have multiple jobs. A large number of operators depend on the supply engineer to select the machinery. So highly specialized is the new equipment that the many operators who cannot keep engineers on the staff trained in equipment performance and

FRED F. MURRAY
President
Dallas

RALPH W. RAGER
Vice President
Dallas

LLOYD E. TRACY
Vice President — Sales
Dallas

G. FRED GOETZINGER
Vice President-Treasurer
Dallas

LESTER H. KEIM
Vice President
Oil City

utilization, look to those of the supply company for the essential job of selection and maintenance of machinery.

An oil company has a tremendous investment in the equipment it needs for all its operations. Generally success depends on keeping the machinery in 24-hour-a-day operation. That means there must be prompt service for every item of equipment used.

"Oilwell" engineers provide the service so essential to that 24-hour-a-day operation. If proper maintenance and repair of equipment cannot be accomplished in the field, the engineer supervises the work in a field machine shop. Supply stores usually do not put up their own machine shops; they use machine shops available to all supply stores and oil companies.

"We've talked a lot of times" said an "Oilwell" executive, "about just where our responsibility does end. How long should we carry parts for a specific piece of machinery—20 years? 40 years? How long should we be responsible for repair and maintenance?"

Research

In John Eaton's time, research was quick and practical. Use for a piece of equipment knocked together in the field would be evaluated and a manufacturer might become interested in producing the tool in quantities.

As time went on "Oilwell" introduced new equipment or improved equipment. There wasn't much research done. A piece was designed, built, and turned over to the salesmen to sell. Sometimes it was slow going but usually the oil operators would eventually accept the innovation.

Now the company is trying to meet the oil industry needs more exactly. Engineers and salesmen in the field report any needs in their areas, which they do not believe are covered by "Oilwell's" present stock. Some items requested seem desirable and a study of the market is made by a commercial research department. Then the item is designed, a few made for testing, and, if successful, it is put into manufacture.

A new invention like the Brantly rotary feed control is put on the market and then developed and improved as it goes into widespread use. When this hydraulic drilling control went into manufacture in the early 30's it was semi-automatic and some skeptical operators thought it just gave the driller more time in the doghouse. Today the control is fully automatic. It regulates the rate of feed so that uniform weight is maintained on the bit. This aids in keeping the hole straight and helps in getting the maximum wear from each bit.

Research is not an ivory tower in the petroleum industry although ivory tower discoveries are sometimes snatched up. Research, in the very practical oil and gas industry, is watching a tool work under widely varying conditions and changing it in design or material in a constant effort to improve its efficiency. So research is carried on by "Oilwell's" field men as surely as it is by the test tube scientists.

In the Dallas headquarters all patents pertaining to the oil industry are gone over and any invention that seems useful is looked into. As an "Oilwell" engineer pointed out, "The method of drilling has changed very little since Spindletop but everything used in the drilling industry is vastly improved. We expect to keep up or keep ahead with improvements."

Besides these direct methods of commercial research "Oilwell" does some pure research (speculative research), and benefits from results of research by United States Steel Company, of which it is a division.

Research, which has grown more effective as it is more effectively applied, is a vital factor in triumphantly reaching a robust 90 years.

Management

These are the things they said—the "Oilwell" people—these are the qualities and policies that keep a business growing. And most of them added, "All of it stems from management."

It is management that must decide on specialization; it is management that must determine where the stores are to be built; it is management that must see the need and if there is no other way to supply it, go out and buy it, as "Oilwell" bought Witte Engine Works; it is management that decentralized its authority yet accepts the responsibility for the efficient operation of the machinery and equipment that is sold; it is management that must know the right decision on a new design that research has dreamed up.

The fact that management must be the source of sound policy and sound expansion is well known and undisputed but in promoting good relations with customers and good relations with employees, management sometimes forgets to promote itself. "Oilwell" management realizes its vital place and, perhaps for that reason, assumes its responsibility confidently.

There is a lot said on the theory that the best management is promoted from the ranks. To "Oilwell" this it not only theory but practice. Fred F. Murray, the president, joined the company 23 years ago. Vice Presidents G. Fred Goetzinger, L. H. Keim, Lloyd E. Tracy, and Ralph W. Rager, have been with Oil Well Supply 38, 28, 25, and 16 years, respectively. This is really growing up in the company.

"Oilwell" isn't exclusive like the union that allows only sons of members to join but it has one unusual example of family preferment. Kenton Chickering was an associate of John Eaton when he founded the business; his son worked for Oil Well Supply and today his grandson, Kenton Chickering, is general sales staff manager.

The Future

What of the future? How will things be when "Oilwell" is 100?

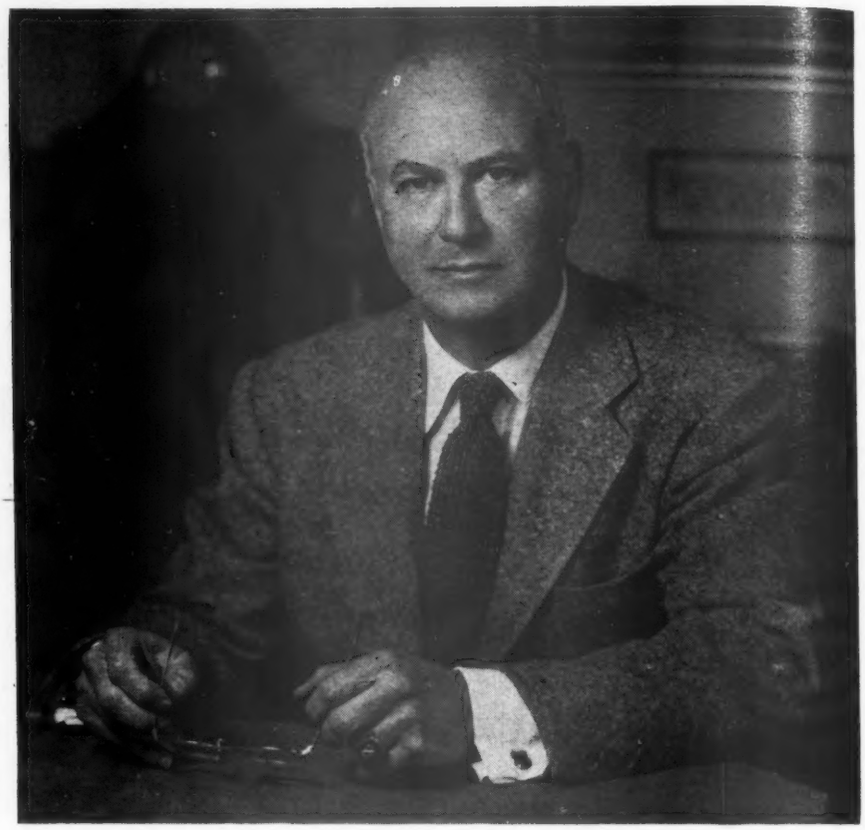
Management thinks "Oilwell" is lined right up with the trend—that the future will be a further exploration under present policies.

One of the factors in this trend is the increased effort to meet needs of the oil industry through taking advantage of the knowledge of trained field men as a forecasting unit and as commercial research initiators.

Another factor in the future will be further development of the staff of field engineers so that operators not only have continuous service but so that they will realize the full application of "Oilwell" equipment to the job.

The essential factor is that "Oilwell" management—which means everyone we've been talking about—has a lively enthusiasm and a quick response to change that is leading the company right up the road to an impressive and eloquent 100th anniversary. * * *

Petroleum Profile



JOHN JAY JAKOSKY

President

International Geophysics, Inc.

JOHN JAY JAKOSKY, president of International Geophysics, Inc., was born in Vinita, Oklahoma, but that fact is certainly not evident in his diction, which is completely free from the nuances and inflections that ordinarily identify the native Sooner. He is a crisp, alert, pleasant mannered chap who has advanced the techniques and improved the tools of his profession in a very substantial way, and, indeed, at this moment gives every indication of being on the road to further consequential accomplishment.

Jay, as he is known to his friends, graduated in mechanical engineering from the University of Kansas and in electrical engineering from the University of Pittsburgh; then, after acquiring a professional ME degree at Kansas, he did postgraduate work at Carnegie Tech and University of Arizona, winding up his academic education with a Doctor of Science degree from the latter in 1933.

In the meantime, from 1920 to 1925 he had been engaged in research engineering for the United States Bureau of Mines, primarily concerning himself with underground communication, subsurface attenuation, and various aspects of geophysics. This was followed by a period of three years as physicist for the Western Precipitation Company and the Research Corporation, during which he was engaged in the development of equipment for eliminating radio interference caused by high voltage precipitators. Subsequently, in consulting work for the Southwestern Engineering Corportation, he conducted an investigation into the employment of high frequency inductive methods for the location of shallow mineral deposits.

In 1929 he organized International Geophysics, Inc., and except for a few years out to devote himself to special academic studies and assignments at University of Kansas and University of Arizona, has been the chief executive of that institution ever since. He has more than 100 patents to his credit and has written a comprehensive text entitled, "Exploration Geophysics" that is probably the most complete and most modern treatment of the subject at present available. It is widely approved and used in college classrooms, and in the libraries of professional consultants, and company exploration departments.

Jay Jakosky has become universally recognized as an authority in the design of geophysical equipment as well as its application. International Geophysics, Inc., under his direction, has concentrated intensively on the development of small, fast, precise field units, and has thus been successful in speeding the equipment function, improving interpretative methods, and simplifying the process of transportation. As a particular aid in interpretative analysis of seismic reflections, the firm has developed a photographic broad-band recording method that permits play-back through any desired combination of filtering and mixing, for use in the more difficult poor-record areas. An important feature of this ingenious process is that impertinent phenomena can be blanked out leaving, in greater clarity, those frequencies and amplitudes that are most essential to the survey.

Although thoroughly occupied in directing the diverse activities of International Geophysics, Inc., Jay Jakosky still finds time to make extra-curricular contribution to the advancement of the industry. He is the author of many illuminating articles on the oil finding sciences and has been a popular speaker over the years at technological gatherings. He is a past president of the Society of Exploration Geophysicists and is an active member of AAPG and AIMME. He used to find his diversion in yachting, but more recently has taken to playing golf at the Bel Air Country Club, and quite freely admits that he is more interested in exercise than expertness. He is also a member of the Los Angeles Petroleum Club, where at extended intervals he employs a game of dominoes to test his familiarity with the theory of probabilities and other abstruse mathematical systems. ★ ★ ★

Hydraulics in the Art of Drilling

INCREASING attention will be given to the study of hydraulics in connection with its importance in drilling fluid systems. It is surprising that as old as the science is more has not been applied in the field of drilling operations.

The dissipation of energy in a drilling circulating system is incredible. In effect, due to the drill stem and its associated pressure losses, only some 15 per cent of useful work is accomplished by an average slush pump. A more scientific approach to the problems of hydraulic energy losses on a drilling rig is warranted.

Considerable discussion has been given to the problems as a whole, but little actual progress has been made. The elimination of constrictions, restrictions, and angular bends is necessary, and thought should be given to the usage of larger internal bore drill collars. By giving due consideration to these points a greater amount of work could be done by the drilling fluid. In addition, an economical gain would also result from less wear and tear of rig equipment.

If the fundamentals were really appreciated, then conservation in rig pump size requirements would become effective, and a smaller type could be utilized for drilling to a greater depth than is possible under most of the existing arrangements.

Today, one drilling technique is the employment of many drill collars in tandem; it is not uncommon to carry as many as 25. The frictional losses in these alone are considerable, but the situation is aggravated when the bore diameter of the drill collar is completely disregarded. This is stressed by the fact that twice the pump power is required under standard conditions to circulate through a 2-in. internal bore collar than for a 2¼-in., although there is only a difference of ¼ in. in actual bore diameters.

One of the arguments cited against drill collars of larger bore is that weight must be sacrificed in order to have the increased bore size. A careful investigation will show that the additional weight gained by employing a smaller bore is not compatible with the advantages in having a drill collar of larger bore.

Another advancement in drilling practice is the jet bit. To obtain the full value of this tool an appreciation of hydraulics is essential, otherwise useful energy will be wasted. (Some future issues of the Continuous Tables will be published on hydraulics for rotary rigs.)

Present day drilling techniques call for a scientific study. This is particularly so in the trend toward the use of high velocity fluid nozzle rock bits. The day is foreseeable when rock bit drilling efficiency, from the standpoint of hydraulics, will be increased to a pronounced degree.

A new line of thinking is developing, and a greater application of the science of hydraulics will be incorporated in the future art of drilling. — J.M.

Now You Can Set these Two

BAKER RETAINER PRODUCTION PACKER PRODUCT NO. 415-D

We realize that your choice of setting method is important, but before we consider the relative advantages of setting methods, let's first analyze the end results obtainable with these tools after they are set.

Among the important advantages of the Baker Retainer Production Packer are its uses . . . for production of one or more zones, simultaneously or separately, for acidizing, for re-pressuring—in fact for every application possible for a packer of its type.

Features which appeal to veteran production men are its Complete Drillability—Resistance to High Temperatures—Corrosion-Resistant Construction—Freedom of the Tubing from the Packer—and Positive Anchoring against Upward or Downward Movement—Bottom-Hole Control with a flapper valve which closes when the tubing is removed, thereby eliminating necessity for killing the well with mud, under normal well conditions.

The wide range of applications, permitting almost unlimited flexibility of subsequent operations, is based upon the construction of the packer itself which employs two sets of opposing slips with a Buna N Rubber packing element between them. When it is set the Packer virtually becomes a part of the casing, cannot be moved up or down, and prevents fluid or gas from passing between the packing element and the casing.

When the Setting Tool (used to set the Packer) is removed from the well, only the smooth-bore Packer remains, securely packed-off, ready for selection and use of the proper Baker Packer Accessory Equipment to meet your production requirements.

It is the extensive line of Accessory Equipment which permits installations to produce from one or more zones, as desired, through tubing or casing—and production changes often can be made without pulling the production string. Complete details of hook-ups, and illustrations of many unique, as well as routine installations, are contained in an 84-page Baker Packer Brochure, gladly sent to you upon request.

SET ON TUBING OR A WIRE LINE

In addition to conventional setting on tubing, the Baker Retainer Production Packer (Product No. 415-D) can be set on an electrical conductor cable by leading service organizations. See listing on opposite page of the organizations in your area, ready to give you prompt, resultful service.

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Baker Retainer Production Packer

Setting Cements in Below Freezing Conditions

Cold temperatures may extend 1000 ft and deeper on far north tests at NPR No. 4 revealed properties needed for best results

MAJOR FOSTER L. WHITE, USAF

PART 1

Proper cementing of casing is a requisite in drilling wells. Generally the underground temperatures that are effective on oil well cements are above normal surface temperatures. This is not true in far northern regions where formation temperatures below freezing may be encountered to depths exceeding 1000 ft. In an effort to determine what happens to cement slurries placed under these conditions and to design slurries that would perform satisfactorily under these conditions an extensive series of tests was made. These tests show that for the conditions presented herein, commercial cements with saline admixtures can be designed and used that will give excellent results. The only field tests conducted to date have shown that such cements are successful in cementing casing.

CEMENTS used in casing work are usually designed to form an impervious seal between the casing and the wall of the hole; to produce fluids from a lower formation under controlled conditions; to seal offensive formations behind the pipe; or, to prevent the flow of fluids between higher formations to or from the well bore. These cements must also be pumpable from the time of mixing until placement in position, develop sufficient strength to support necessary pipe loads, and become a permanent solid substance under widely varying sub-surface conditions.

Due to the widely varying sub-surface conditions encountered, different types and brands of cements to be used with or without additives have been developed to give satisfactory results. For a specific well the primary factors that will control the ability of a cement to set with sufficient strength and impervious in a given period of time are pressure, w/c ratio, and temperature.

The effective pressure on a cement slurry is a function of the depth and hydrostatic head of fluid. For a given depth, variance of the effective pressure on any two slurries is determined by the difference of their densities, provided the same quantity of cement and the same applied pressure are used while placement is being accomplished. Previous work by the author[1] and others has shown that pressure affects the strength and properties of cements. High pressure will accelerate the rate of thickening and decrease the setting time of a slurry[2]. Within the range of pressures tested to date, high pressure will result in a stronger cement than that obtained at atmospheric pressure under standard laboratory conditions[1]. In present day usage cement slurries are not usually tested or selected for their reaction to pressure. When laboratory tests made with a pressure thickening time tester indicate that the slurry being tested could not be placed in position in the time available for pumping in a known well, another type of slurry is selected.

W/c ratio can be varied to obtain the desired slurry, generally within limits dictated by pumpability requirements. Lowering the w/c ratio results in a denser and stronger cement.

Temperatures that affect the properties of cements used in casing work are those that are found in the well bore. It is this factor for which most cements are designed by adjusting the chemical composition and fineness of the cement during manufacture. High temperatures found in deep wells will result in cement slurries setting up in shorter periods of time to the extent that "flash sets" can occur. Up to the present time the design of cements has been concentrated toward the prevention of these "flash sets". With the extension of drilling into northern climates, the problem becomes one of obtaining sets with cements at low temperatures rather than at high temperatures.

Recent work by the API Sub-Committee on Oil Well Cements[3] shows that the average static temperatures of Gulf Coast wells vary from about 80 F at ground level to 305 F at 15,000 ft, or a gradient of 1.5 F per 100 ft of depth for these thick sedimentary sections. This gradient may approach 2 F per 100 ft where thinner sedimentary sections exist. These are standard temperature gradients that may be assumed for sedimentary formations. During cementing operations the static temperature will not be completely effective until after the cement has been placed in position for a sufficient time to allow a heat transfer to take place between the slurry and the formations. Mud circulation prior to cementing operations will decrease the bottom hole temperature adjacent to the well bore due to loss of heat to higher, colder formations and the cooling that takes place in the pits. It is known that if extremely high static temperatures were effective upon cement slurries while being placed in position a "flash set" would occur before placement could be accomplished.

The normal initial static temperature below a zone of seasonal variation will approximate the mean surface temperature. As one proceeds northward from the Gulf Coast region, the initial value of static temperature will decrease with the mean temperature until a point is reached where the ground is found to be permanently frozen. Such permanently frozen ground has been appropriately named "permafrost." This permafrost section creates problems not only in the cementing of casing, but also in the construction of foundations to support heavy equipment installations. The areal extent of the permafrost is approximately one-fifth of the land surface of the world and with the ever-increasing interest in Arctic operations, the study of the use and performance of cement placed at low temperatures becomes more important. Discussion of the factors relating to cements used under these conditions will be confined to those that have been found in Naval Petroleum Reserve No. 4. This Reserve is north of the Brooks Range in Alaska and has a land area of approximately 37,000 square miles.

Above 1500 ft the formations drilled in the Reserve have been, in general, dirty sands, silts, and clays of Cretaceous age or younger, interspersed with thin ice lenses. In this interval are few sands that exhibit high porosities or permeabilities. The clays are excellent mud makers and, except for spudding-in operations or to control pressures, very little artificial mud is required. Little is actually known about the ice content of these formations, but probably most contain ice to 100 per cent of their pore space. Muller[4] states that sandy or coarse-grained clastic material that drains easily is normally dry frozen. It is believed that very few of the formations penetrated to date fall within this category. Generally, the formations of

[1]Numbers refer to bibliography at end of Part 2, to be published soon.

EXCLUSIVE

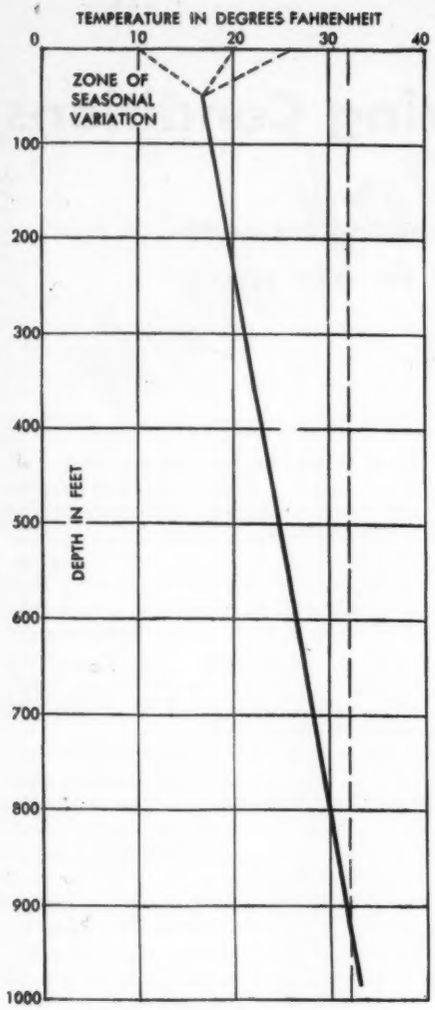


FIG. 1. A typical static temperature gradient of holes in the vicinity of Point Barrow from data of Dr. MacCarty U.S.G.S. Temperatures obtained from Thermister cables placed in drilled wells. Readings made after temperatures were stabilized.

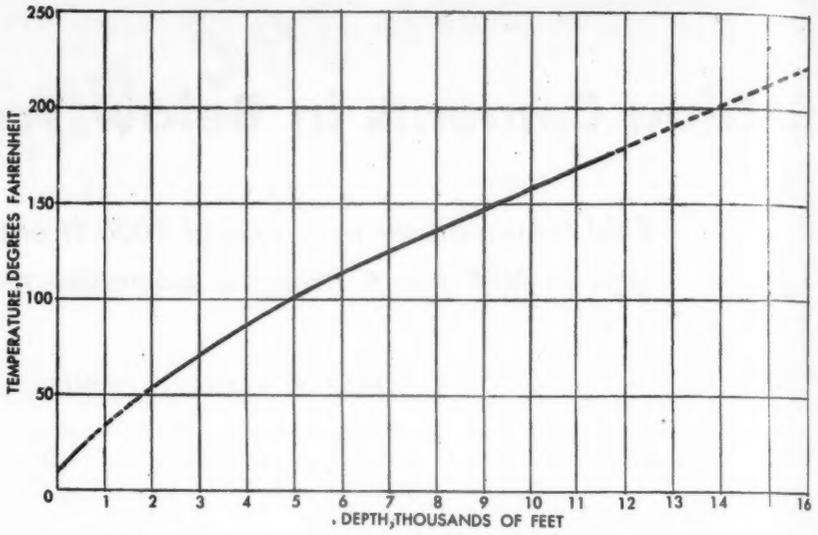


FIG. 2. Average bottom hole temperature vs depth for holes drilled on Naval Petroleum Reserve No. 4. Data obtained from maximum recording thermometer attached to Schlumberger Sonde. Readings are from runs to bottom at the time that depth was reached.

this section are not considered as competent formations but stand up well under the hydrostatic head of mud applied.

The thickness of the permafrost section in the Reserve varies some with locality but can approach a depth of 1000 ft or greater as determined by temperature measurements in drilled wells. Dr. G. R. MacCarthy and Dr. J. H. Swartz of the U. S. Geological Survey have been placing, and are continuing to place, thermistor cables in suspended wells that have penetrated the section. At regular periods of time temperature readings are recorded, which show the depth of frozen ground before and after stabilized conditions are reached. Fig 1 is a schematic diagram showing the approximate temperatures found in the Barrow area. These are static temperatures and are not those that would be effective during the initial stages of cementing operations.

After the permafrost section is penetrated the temperature will increase with depth at a rate roughly equivalent to the normal gradient. Fig. 2 is an average curve of the bottom hole temperatures found in holes drilled on the Reserve. From this it can be seen that once a depth of 1500 ft is reached no trouble should be encountered in obtaining good cement jobs with cements presently available. This paper will be primarily concerned with designing and testing of cements to be used in the section from 0 to 1500 ft where temperatures will vary from 15° to 40° F.

Theory

For a given frozen formation that has been thawed by the circulation of hot fluids, the elapsed time required for the temperature to approach the original static value is a function of the distance thawed back from the wall of the well and is bound by the volume, velocity, and temperature of the mud circulated and the specific heats of the formation, drilling fluids, and pipe. Because of the latent heat of fusion, thawed formations, when subjected to temperatures below freezing, will have a time period when the temperature will be stabilized at 32 F before refreezing. Muller[4] presents a chart showing the temperature of freezing ground as a function of time where the freezing temperature of a sample of ground originally at 60 F was exposed to below freezing temperature. A temperature of 32 F was reached in approximately 45 min and remained at that temperature for over two hours before continuing its downward trend. It is not believed by the author that after stopping circulation, where formation temperatures of 15 F are encountered, that the temperature of a well bore will remain above the freezing point for an appreciable length of time unless a great deal of heat has been added over a long period of time to thaw the formation back a sufficient distance from the well bore to slow down the movement of the freezing line.

Long periods of heating of the top formations could result in the undermining of rig foundations, and sloughing off of the walls of the well, particularly where porous ice lenses are found. From the conditions pointed out above it would seem advisable that cements to be placed in this section be designed for one of two conditions. These are: (1) cements that will develop the necessary physical qualities and strength before freezing temperatures are established after circulation is stopped and that will be unaffected by thawing after having once been frozen or (2) cements that will develop and retain the necessary physical qualities and strength when set at temperatures below freezing.

No published article could be found dealing with the effect of freezing oil well cements. Results of such tests conducted with concretes for construction use were found. Some of these results are applicable to oil well cements.

Effect of Immediate Freezing[5]. 1. Concretes frozen immediately upon placement but later allowed to set under favorable temperatures attain approximately 50 per cent of the strength of unfrozen concretes at the same age.

2. There is some indication that (a) this 50 per cent of normal strength becomes greater with age, approaching a higher proportion of normal strength, and (b) cements with high w/c ratios are more seriously injured than those with low w/c ratios, with no apparent difference in resistance to freezing because of a high or low w/c ratio.

3. The effect of immediate freezing will result in an increased permeability.

Effect of Delayed Freezing. 1. If cured for a sufficient period of time prior to freezing no practical injury will result with cements having low w/c ratios. Slurries having higher w/c ratio and those cured in water require a longer period of time for curing prior to freezing.

The harmful effect of freezing of con-

FIG. 3. Cans of cement and equipment used in performing cementing tests.

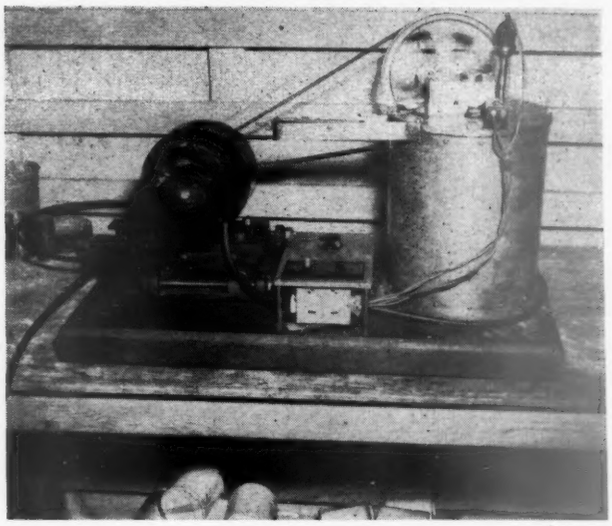


FIG. 4. Cement thickening time tester.

FIG. 6. Tensile testing machine mounted in reefer.

FIG. 5. Sieve shaker mounted in laboratory.

cretes has been of sufficient importance to warrant publication by the ASTM of minimum temperatures under which concretes should be placed and cured.[5] Under no circumstances should the temperature be allowed to fall below 40 F, and should be maintained above 50 F. Acceleration of the setting time of cements may be obtained by use of $CaCl_2$ thereby reducing the time required to protect concretes from freezing temperatures. The use of $CaCl_2$, cannot be depended upon to reduce the freezing temperature of the slurry, as the amount required to reduce appreciably the freezing point may produce a "flash set" and a large reduction in strength. In using $CaCl_2$ cements for oil well work it is probable that the necessary pumpability could not be obtained using large percentages of this additive with normal w/c ratios.

The time required for initial and final set of a slurry is not a straight line function with temperature but approaches high values at low temperatures. Cements that are exposed to temperatures below freezing, within a short period of time after mixing, may have their rate of setting slowed down sufficiently to permit freezing before a set can take place.

Preliminary experiments conducted at the beginning of exploration on Naval Petroleum Reserve No. 4 had indicated that cements using 4 per cent $CaCl_2$ by weight of cement would set before they were frozen at temperatures found in the permafrost. It would, however, be a soft cement and require heat to harden. It was recommended that the addition of heat be accomplished by circulating hot mud. To be certain that the cement was set and hard, an extension of time before drilling out the plug was also recommended. Use of this type of slurry in the permafrost section has not generally resulted in successful jobs. It

FIG. 7. Breaking mechanism of tensile testing machine mounted in refrigerator.

was with the purpose of determining the cause of these failures and to develop cements that would give successful jobs that the work presented in this paper was performed.

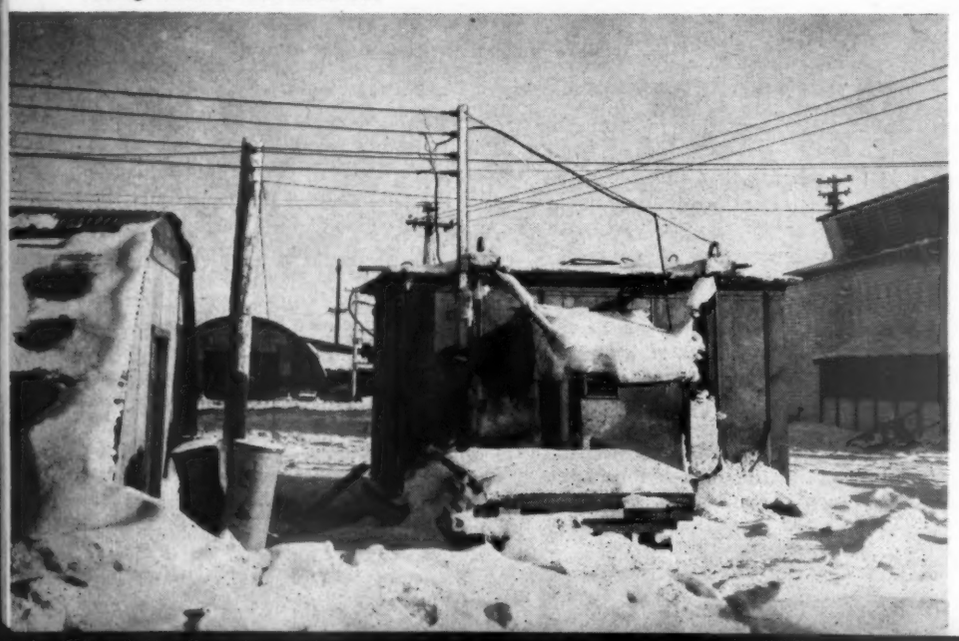
Recent work by Halliburton Oil Well Cementing Company[7] has shown that NaCl can be used as an additive to cements up to a saturation of 25 per cent NaCl by weight of water. Lange's Handbook of Chemistry shows that NaCl in solution with water will lower the freezing point below those temperatures found in the permafrost. Water containing 15 per cent salt by weight has a freezing point of 12.4 F, which approximates the lowest temperature encountered to date in the permafrost section below the zone of seasonal variation. Cements mixed with NaCl show a longer setting time at the lower temperatures than at higher temperatures for the same per cent of additive used. The setting and pumping time of these cements was at a minimum when the mixing water contained 6 per cent NaCl by weight of water. Cements mixed with fresh water and those with about 18 per cent NaCl have approximately the same pumping and setting time. In general the compressive strength of cements with NaCl added was at a maximum at approximately 1 per cent concentration. The compressive strength of these slurries was at a minimum when a slurry was mixed with 25 per cent salt water. It should be pointed out that the high strengths developed by Porland cements are not necessary for casing cementing work. Minimum strength that has been found safe approximates 10 psi tensile strength, provided the final set has taken place and sujcient cement has been used for this strength to support the string of pipe being cemented. Slurries mixed with saturated salt water will make cements having greater strengths than this minimum value.

It would seem plausible from the above discussion that by use of $CaCl_2$ the setting of a slurry may be accelerated to a final set prior to the time the walls of the well and the slurry reach a freezing temperature. On the other hand, by use of NaCl the slurry may be prevented from freezing, provided that the hydration of the cement will continue after the slurry has reached the static temperature of a frozen formation in which it is placed.

Other cements that are not considered as belonging to the family of cements normally used in oil well work may be used with better results than those discussed above. Gypsum cement falls within this category and has been successfully used for many special jobs. This cement will set at temperatures from 32 to 140 F in a shorter period of time than standard oil well cements, and the setting time can be controlled within rather narrow limits.

With the conditions that were to be encountered determined, work was initiated to design and test cements that would result in successful jobs with a minimum of lost time waiting on cement.

FIG. 8. Laboratory (end) and refrigerator where tensile testing machine was mounted.



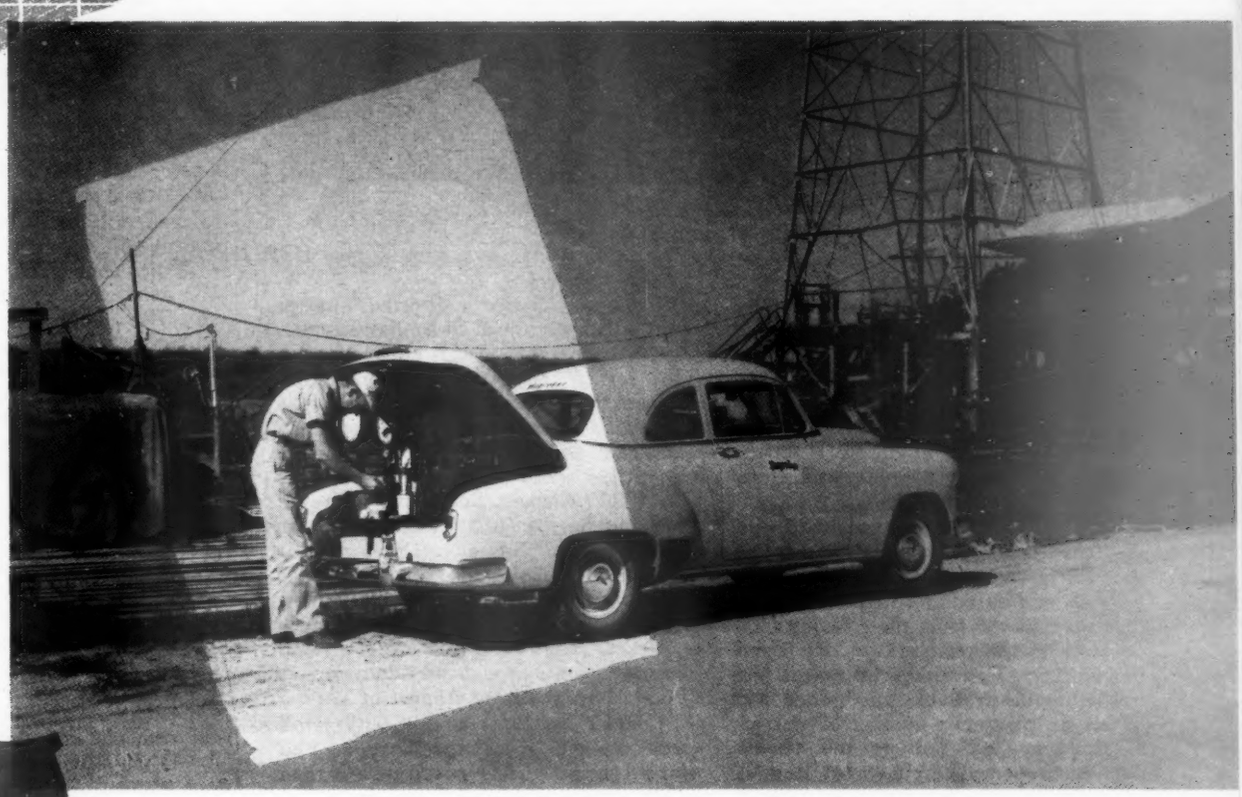
Apparatus, Procedure, and Materials for Laboratory Tests

The apparatus used in mixing and making the necessary tests of the cements investigated consisted of: Vicat needle for setting times, a standard kitchen-type mixer for mixing the slurries, standard ASTM tensile briquet molds for tensile tests, standard Baroid mud scales for determining slurry weights, a California type thickening time tester for testing consistency, standard laboratory equipment for measuring and weighing the components of the mixes, a set of screens and mechanical shaker for sieve analyses, and a simple second class lever with tensile jaws mounted thereon for tensile strength tests. This equipment is shown in Figs. 3 through 7. The mixing of all samples was performed in a Quonset hut at Point Barrow, Alaska, which had previously been used for soil test work. Immediately to the rear of the Quonset a refrigerator was placed as shown in Fig. 8. During the time tests were conducted, temperatures of the outside air were at least zero or below. A thermostatically controlled electric fan type heater was used to maintain desired temperatures within the refrigerator. With the exception of the first few preliminary tests when the refrigerator was set at 28 F the stabilized temperature maintained for tests below freezing was 15 F $\pm$ 3 F.

Mounted within the "reefer" was the machine used for making tensile tests. This machine was a simple second class lever balanced on knife edges and had a 21-1 mechanical advantage. Standard tensile test jaws were mounted on the machine as shown in Figs. 6 and 7. Construction of the machine necessitated the preloading of all samples with 7 psi prior to adding the weights creating the force for breaking the briquets. Small uniform weights were added to the end of the beam in an even flow until the briquet failed. Each weight gave an approximate tensile load of 1 psi upon the briquet. With the mechanical advantage known the load at the end of the beam was weighed and simple calculations made to determine the tensile strength of the sample. On those samples where high tensile strengths occurred or where the sample stretched or compressed within the sample jaws the beam could not be maintained in a level position. This change in level would change the length of the lever arm but is so insignificant that it is ignored.

Procedures used in mixing and testing of the cements conformed with those given in the API Code (Tentative) for Testing Cements Used in Wells with the following exceptions: Temperatures used for mixing, setting, and curing samples and for the consistency tests were those that were applicable for the conditions found in the Arctic. To obtain a comparison of results on setting times three temperatures were chosen—70, 40, and 15 F. It was assumed that if cements could be designed that would give satisfactory results at 15 F they would also be satisfactory at higher

SINCE 1941 the average total drilling cost has increased more than 60%



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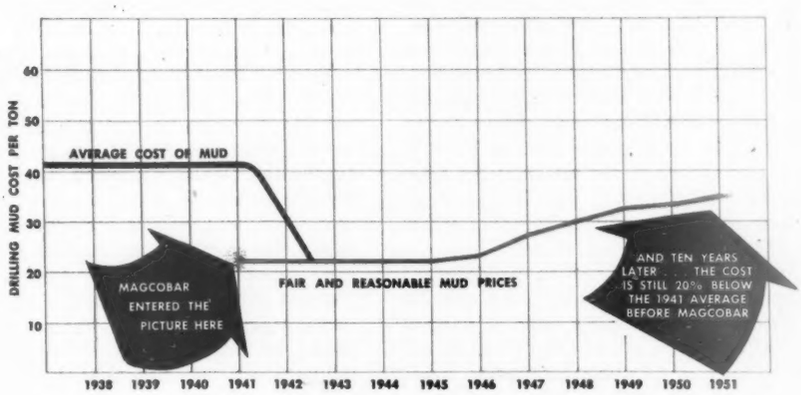
DRILLING MUD COST PER TON
60
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40
30
20
10
AVERAGE COST OF MUD
MAGCOBAR ENTERED THE PICTURE HERE
FAIR AND REASONABLE MUD PRICES
AND TEN YEARS LATER . . . THE COST IS STILL 20% BELOW THE 1941 AVERAGE BEFORE MAGCOBAR
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FIG. 9. Inside laboratory. Hot water tank mounted on oil stove.

temperatures. Due to weather conditions existent at Point Barrow during the tests, the construction of the Quonset, and the heating system employed, the two higher temperatures of 70 and 40 F could be maintained to only ± 10 F. This was reflected in different setting times of identical samples, caused by the temperature fluctuations.

Strength tests were all performed with the tensile testing machine mounted in the refrigerator. Those samples that were set and cured at a higher temperature were moved from their curing temperature to the refrigerator and tested immediately. The number of tensile test briquet molds available was limited and to test the maximum number of slurries at different test periods the tensile strengths reported herein do not, in most cases, represent an average value of 3 samples as is usually reported.

Attempts were made to test the briquets for tensile strength at 1, 3, and/or 5-day intervals. Extended setting times and other factors made this impossible in certain cases, and tests were performed at the earliest time the sample was expected to have a minimum strength that could be tested in the machine used.

Strength tests were mostly performed on those samples set at 15 F. Those samples that showed promising results were tested for tensile strength at the higher temperature. Thickening time tests were performed only on those samples that exhibited desirable qualities. These tests were conducted under two conditions—(1) at a stabilized temperature of 80 F, which would probably exceed the maximum temperature conditions to be encountered above 1500 ft, and (2) placed in the tester at the time the bath temperature was 40 F and allowed to cool to below freezing while the test was being performed.

Tests were conducted on six different types of cements, four of which can be considered as currently used in normal oil well cementing and two of which can be considered as special cements. Each cement was given a specific number and will be referred to by that number for the remainder of this paper. Cement No. 1 is an oil well, high temperature cement whose specification calls for a minimum thickening time of five hours at 200 F and a briquet strength, using a .40 w/c ratio, of 350 psi in 24 hours at 200 F. Cement No. 1 was delivered to Point Barrow in August of 1949.

Cement No. 2 is an oil well regular type "C" cement whose specification is unknown, and arrived at Point Barrow during June, July, and August of 1949.

Cement No. 3 is a standard Portland cement Type 1, which was delivered at Point Barrow during August of 1949.

Cement No. 4 is a slow-setting, oil well cement whose specifications call for a specific surface not to be less than 1300 square centimeters per gram and a pumpability time on a consistometer test to be not less than four hours at 160 F.

Cement No. 5 is a special cement manufactured from bauxite and has chemical and physical properties unlike those of Portland cement. One sack of this cement was procured for test purposes only and was delivered to Barrow during March of 1950.

Cement No. 6 is a gypsum cement whose setting time was given as 60 minutes, and was delivered to Barrow in October of 1949.

Cements No. 1 through No. 4 were shipped to Point Barrow in steel cans containing two and one-half to three sacks per can. Two different types of cans were used, as shown in Fig. 3. Cements on arrival at Barrow are stored outside and covered with tarpaulin until used. Cement in cans of the spring-type lid, as the one at the left in Fig. 3, are subject to some damage because of leakage of moisture along the seams of the can. Cement in cans of the bolt-type lid are generally found to contain unharmed cement and show no apparent damage because of exposure to extreme cold, but should be heated to as high a temperature as practicable prior to actual mixing and placement in a well. Sieve analyses were performed on cements to assure that they conformed with ASTM standard specifications.

Water used for the tests was obtained from a fresh water lake adjacent to Point Barrow. An individual water system was contained within the Quonset and was filled periodically. A portion of this system, excluding storage tanks, may be seen in Fig. 9. In general, the water that is found and that would be expected to be used in cementing work in the Reserve is fairly uniform and is sufficiently pure to be used as drinking water without treatment.

Chemicals that were used as additives in attempts to control the setting times and prevent freezing of the slurries were $CaCl_2$, sodium chloride, sodium bicarbonate, and magnesium sulfate. The $CaCl_2$ was a standard commercial chemical generally used for accelerating setting time of cements and is approximately 73 per cent pure. The sodium chloride used was ordinary iodized table salt. The sodium bicarbonate was a commercial brand used for treating muds. The magnesium sulfate was Epsom salts of the commercial variety obtained from the dispensary. In all cases where additives were used in mixing of a slurry the chemical was dissolved in the water prior to the time mixing of the cement was initiated. To achieve identical concentrations of the chemicals regardless of w/c ratio, values given for the additive are weight of chemical by weight of water.

In addition to testing cements with different chemical additives, a number of slurries containing combinations of various percentages of the different oil well cements and the gypsum cement mixed dry before adding to water were also mixed. Any slurry that contained a mixture of these two types of cement are classified as No. 6, or gypsum cement. Cement No. 3, or standard Portland cement, was used with all additives to obtain comparable data. One series of tests was performed using Cement No. 3 containing 5 per cent Bentonite added dry with calcium chloride as an additive in the mixing water. A standard w/c ratio of .44 was established to be used with all slurries regardless of type of cement to be used, except: (1) where Bentonitic slurries were used it was necessary to increase the w/c ratio to obtain pumpability and (2) in the Type 6 cement with and without other cements aded the w/c ratio was changed to determine its effect upon setting time.

More than 60 different slurries were tested in combinations of all the additives and cements listed above. Many of the data obtained from tests conducted on these slurries are of course in the nature of negative results so far as this paper is concerned. All data will be reported in the latter part of this report, however, in order that a comparison might be made of the effect of the different additives on each slurry.

Part 2 will be published soon.

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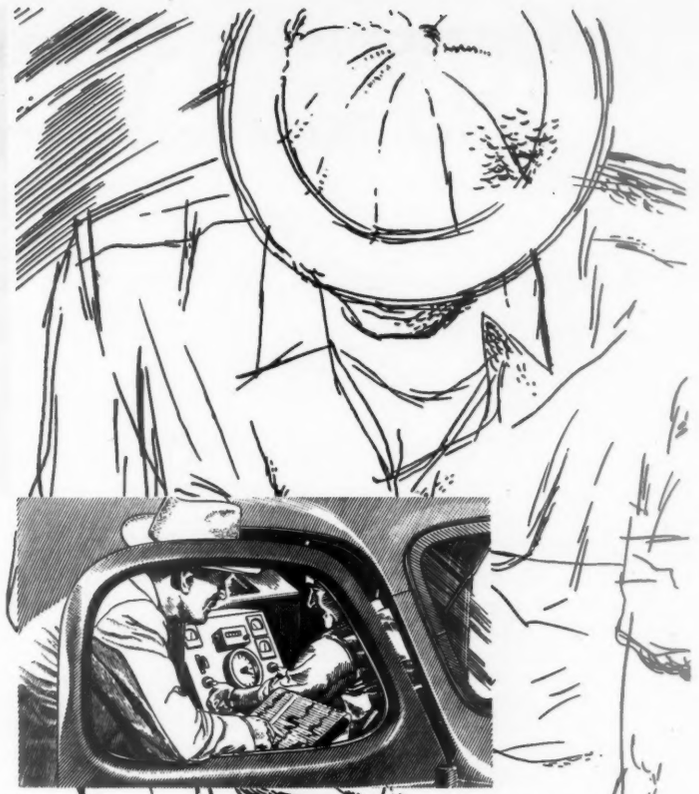

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Magnetometer Surveys in New Mexico Areas

Results are confidential but maps of structures in Lea County and the San Juan Basin show possibilities

J. L. HARPER

The Author

J. L. Harper is a consulting geophysical engineer in Evansville, Indiana, and Albuquerque, New Mexico. He was educated in several schools in U. S. and foreign countries, including many specialized courses. He spent several years as a licensed engineer in Canada and has had many years' experience as magnetometer operator in most of the oil fields of the U. S., Canada, and parts of Mexico. Harper is author of *Oil-Gas Geology of Southwest Ohio* and *Resistivity Method of Locating Oil and Gas Pays*, and other scientific reports and articles.

MAGNETICS have been used from very early times. Perhaps at first by seafarers, later by compass surveys. Then by instruments applied to the location of iron. Later by the aviator, and then by the engineer using magnetic methods in prospecting for ores and structures thought suitable for the accumulation of oil or gas.

There is quite a large literature and the various instrument techniques are too well known to require comment.

A great part of the magnetometer surveys on oil prospects or wildcat areas have been based on the so-called crystalline rocks or granite, using these rocks as datum. This has of course supplied data upon the configuration of the crystalline floor.

To apply effectively to possible oil-bearing structures, however, other field and instrument techniques must be used, and datum beds in the sedimentary column must be found. There are certain magnetic beds in the sedimentaries. Of course these beds are found at varying depths over the vast area of the United States and Canada that are now known oil fields or suspected prospects.

In the use of the magnetometer on ore bodies it became a vital part of the survey to determine or at least get a very good approximate idea of the depth; otherwise the sinking of too deep shafts would make the cost prohibitive.

Again the literature of the past supplies the rules and equations for this depth determination.

In an article on magnetometer surveys in New Mexico it is not possible to include the many years of field work in most of the United States, Canada, and Mexico. It provides a vast storehouse of information and experience to draw upon, however, and thus apply this needed and necessary knowledge to field use and interpretation in New Mexico.

Perhaps the airborne magnetometer surveys and accompanying contour maps of the crystalline rock pattern will provide data that might lead to discovery of oil structures. Parts of Guadaloupe, De Baca, and San Miguel counties, New Mexico, have been surveyed by the airborne method and the resulting contour maps have been released by the United States Geological Survey.

Two ground magnetometer surveys in these areas based upon beds in the sedimentaries have been completed by our operators. The resulting contour maps do not conform to maps of the airborne surveys. The highs as found by the ground magnetometer surveys, however, do give a structural picture greatly similar in outline to structures as worked out by surface geology. The surface high is not directly above the magnetometer high, but is set off to one side. There is not sufficient data available at this time in New Mexico to make a statement as to the directions these different highs are

EXCLUSIVE

FIG. 1.

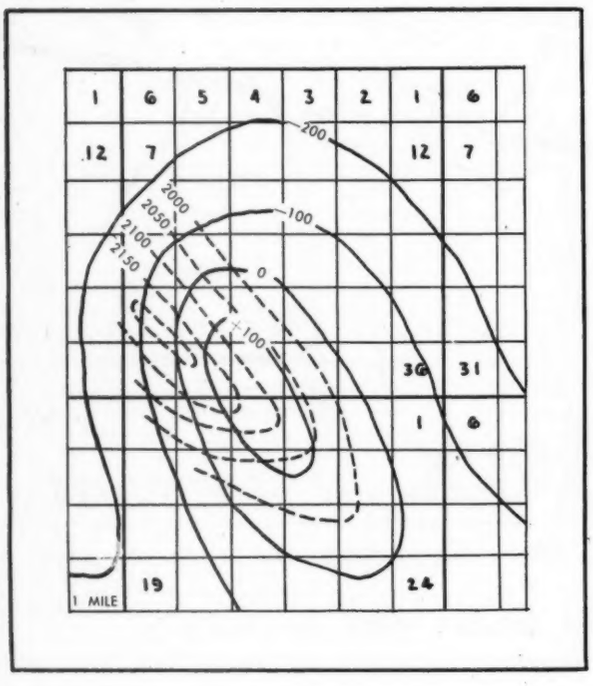
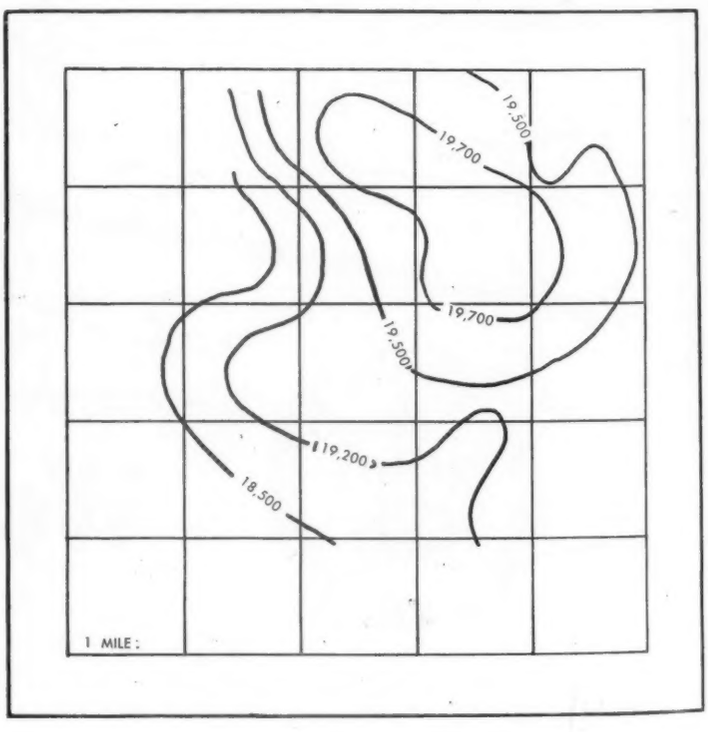
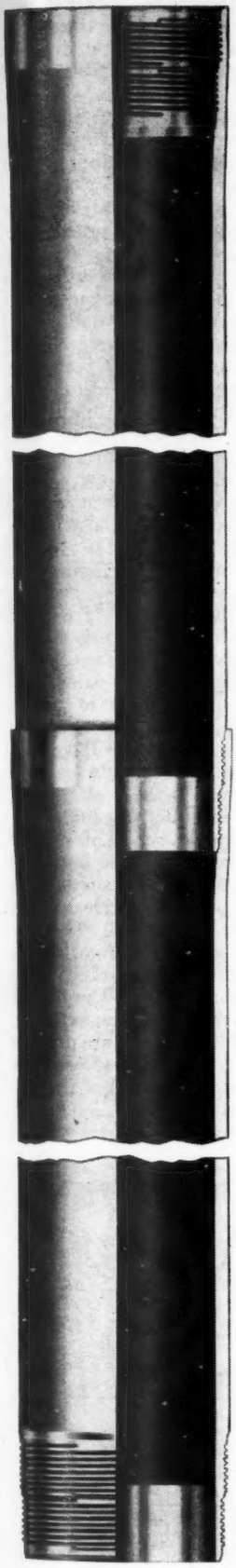


FIG. 2. ⟶





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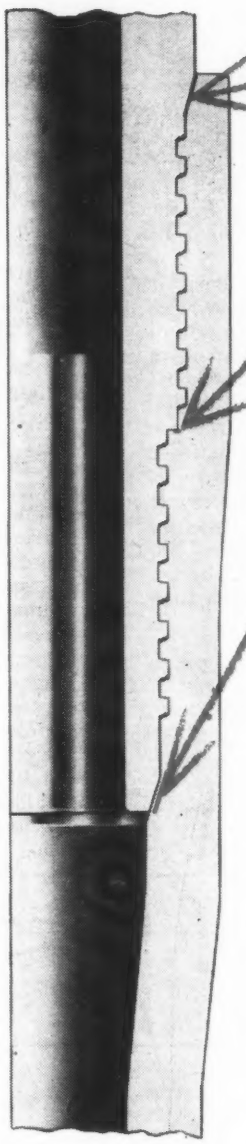

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	Collapse SF = 1⅛	Tension SF = 2	
	Feet	Feet	1000 Lbs.
5½—14# J-55	5,640	8,900	244
5½—15.5# J-55	6,860	9,380	288
5½—17# J-55	8,000	9,780	330
5½—17# N-80	10,470	11,140	376
5½—20# N-80	13,480	11,790	467
7—20# J-55	4,440	9,010	352
7—23# J-55	5,850	9,630	436
7—23# N-80	7,640	10,980	497
7—26# J-55	7,220	10,090	518
7—26# N-80	9,460	11,520	591
7—29# N-80	11,320	11,920	685

Joint Tension Strength is based on 55,000 Yield and 92,000 Ultimate for J-55 Material, and on 80,000 Yield and 105,000 Ultimate for N-80 Material.

The Tripleseal joint is applied to plain end casing by a Hydril-developed method of cold expanding one end of the pipe for the box thread and cold nosing the other end for the pin thread. This process efficiently distributes the metal in both the box and pin sections to produce high joint strength.

U. S. Patent 2,211,179 and Patents Pending.

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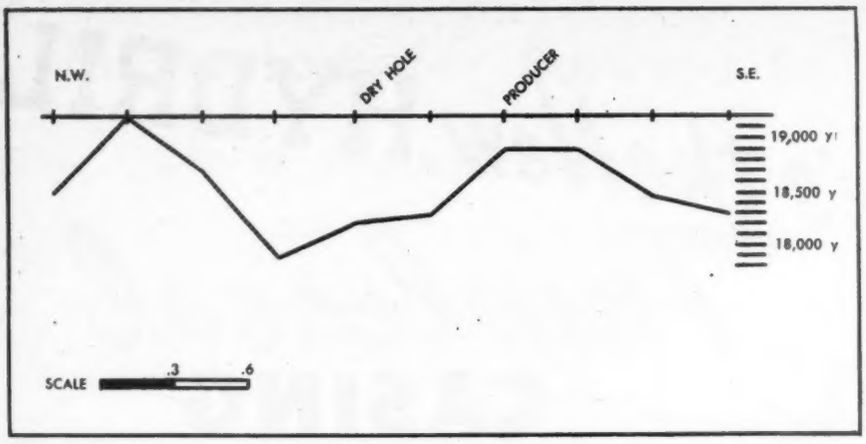


FIG. 3.

expected to be, one from the other. In other states after examining many surveys it appears there are certain definite patterns of directions of these displacements.

The Hobbs pool in southeastern New Mexico was a magnetometer discovery, and according to many of the publications on geophysics and geology it is carried as a more or less type illustration.

Fig. 1 is a contour map in gammas from magnetometer survey of the Hobbs pool, in Lea County, New Mexico. It was located in 1926 by a Midwest magnetometer crew. At that time, as well as the present, some of the operators use instruments calibrated to a scale of zero, and thus the values are plus or minus. Later drilling at Hobbs disclosed the sub-surface structure, as shown by the dashed contour lines using the top of the anhydrite.

A structure in the San Juan Basin is shown in Fig. 2. Here the gamma value is based upon instrument calibration of the gamma being 100,000th part of an oersted. The U. S. Coast and Geodetic Survey have established many magnetic stations in New Mexico. Thus the use of this method can be checked at these stations. This contoured structure is large, has ample closure, and is as yet undrilled. A surface geological structure is in evidence, but its high is not directly over the magnetometer high.

Fig. 3 is a profile of another San Juan Basin structure, previously partly drilled. It was discovered by surface geology, and due to lack of outcrop the dry hole was quite unexpected. Further structural features to the northwest were not visible to the geological party. Since the magnetometer survey another producer has been drilled in to the southeast of the producer as shown.

Fig. 4 shows sedimentary structure in the area of the airborne magnetometer survey. This structure is rather sketchily outlined on the airborne contour map as a structure in the basement rocks. It is not directly beneath the ground survey, however. This is also a known geological structure as found several years ago. Again the geological high is not over the surface magnetometer survey high, but is to one side. Geology assumed the drilling location was on structure, but the magnetometer discloses a low indentation, and thus a very poor location.

Another structure in the area of the airborne survey is found in Fig. 5. Structure does not appear on that survey. The contours are on the sedimentaries, and depth can be fairly well calculated. A previously known geological structure, worked from surface beds, is set slightly aside from this structure at depth. It would be difficult to make a drilling location on one that would not be off the other. Drilling will be done this year. There are bituminous sandstones outcropping in the area.

Much of the information obtained by a magnetometer survey, is of its very inception the property of the individual or company sponsoring the survey. It is not possible to publish or release these data for the use of others.

Thus a great part of the knowledge is to a more or less extent locked in the field notes of the operators. The natural secretiveness surrounding the surveying and finding of suitable structure prevents the oil industry from having access to the fastest and most economical of the geophysical exploratory tools. * * *

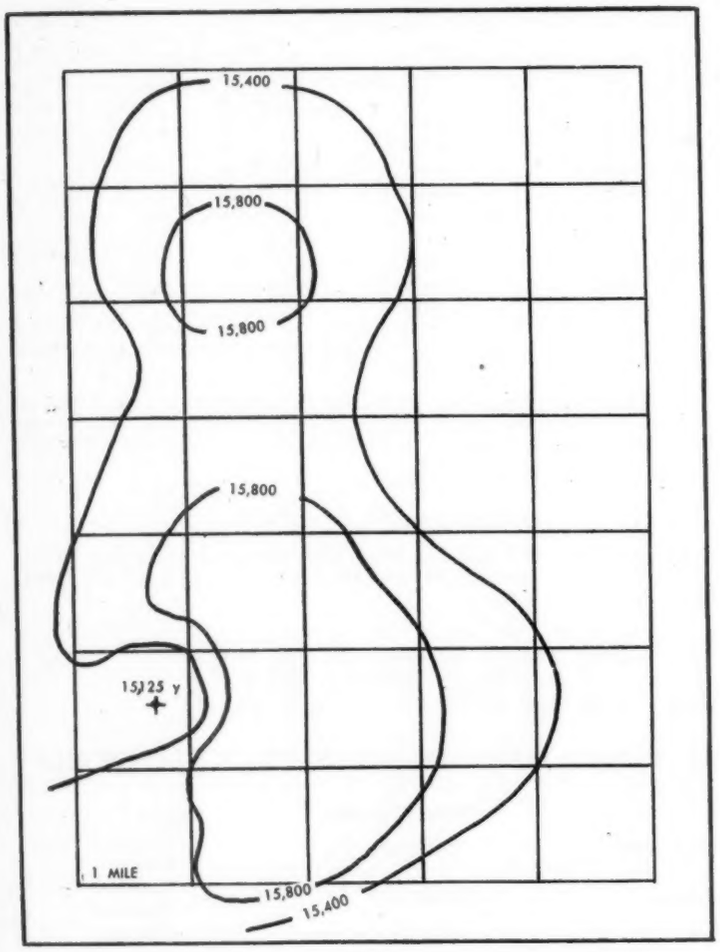
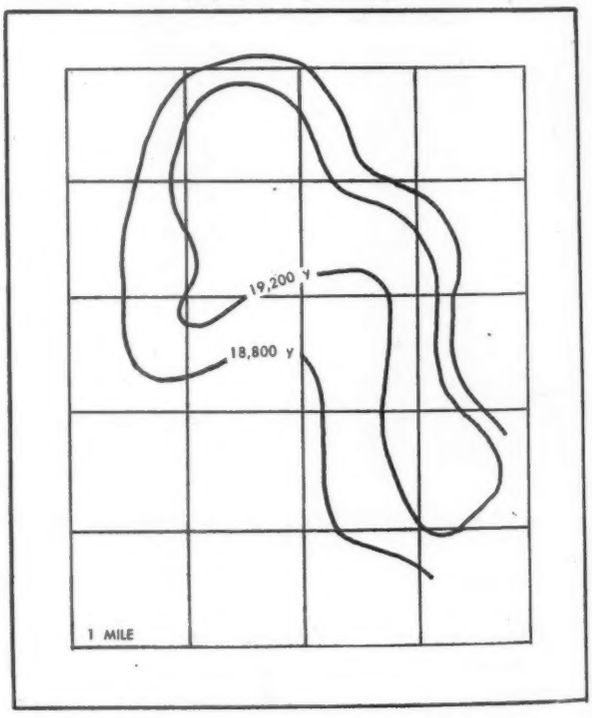


FIG. 4.

FIG. 5.



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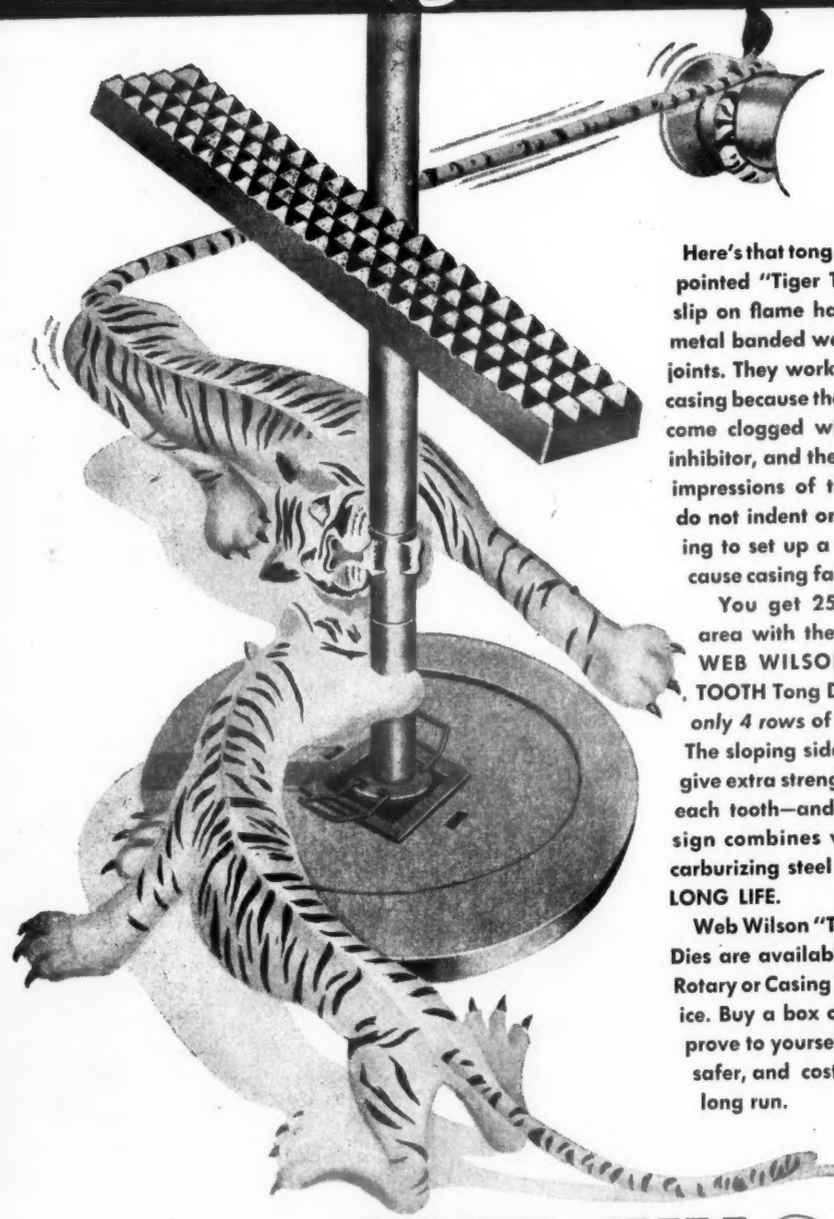

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Loss of Mud Solids to Formation Pores

Laboratory tests are used to investigate mud loss and effect of various factors is shown

CARROL M. BEESON AND CHARLES C. WRIGHT

The paper deals with the loss of mud, including solid particles, to formations. It is emphasized that lost circulation is not under discussion, but the entrance of whole mud, as well as filtrate, into pore channels of sizes that exist in productive oil sands.

Laboratory measurements are given to call attention to the fact that mud loss often is of sufficient magnitude to warrant serious investigation. Data are included to show the effect of the factors that would be expected to influence mud loss, that is permeability, type of mud, temperature, and pressure. Effects of the introduction of several mud additives are included to indicate a method of controlling this possible source of damage to subsequent production.

Introduction

THE petroleum industry is well aware of the fact that productivities often may be seriously altered during the drilling and completion of oil wells. A great deal of effort has been expended in determining and minimizing the various sources of damage to subsequent production.

The literature gives little indication, however, that the industry is conscious of the damage that may be caused by the loss of mud to oil sands prior to and during formation of the mud cake. In this connection it should be emphasized that lost circulation of mud due to the presence of fractures or similar large openings is not under discussion; but rather the entrance of whole mud into pore channels of sizes that exist in productive oil sands.

One purpose of the present paper is to call attention to the fact that, in many instances, the amount of the mud loss to formation pores is of sufficient magnitude to warrant serious consideration. Another objective is to demonstrate a method of minimizing this possible source of damage to subsequent production. The magnitude of the mud loss is shown by measurements on both unconsolidated and consolidated sands. The control of mud loss is indicated by its reduction through the addition of solids to give the proper particle-size distribution to the muds.

EXCLUSIVE

Theory of Mud Loss

After a mud cake has formed on a porous medium, only the liquid filtrate, and possibly the finer particles and globules, can pass through the cake. The bridging of the solid particles and globules, however, does not necessarily occur entirely at the face of the well bore. For this to be the case, the particle size distribution would have to be such that bridging takes place across all enlargements, as well as all constrictions, in the pore channels.

It seems more likely that only the larger particles will be filtered out at the face of the well bore, with the remainder of the whole mud entering many of the pore channels. This partially filtered mud would be expected to flow into the formation until a constriction is reached that is of the proper size and shape to permit practically complete bridging by the particles and plastering agents contained in the mud. At this point of formation of the cake, only the filtrate would continue to flow in that particular pore channel.

As the pore channels must differ considerably in configuration, complete bridging may well occur at different distances from the face of the well bore. This would cause the formation of a cake with a shape similar to a cow's udder. As the filtrate may flow in all directions from such a cake, the effect would be that of a cake of considerably greater area than that of the well bore. This type of cake formation would give rise not only to mud loss but also to an increased filtrate loss after cake formation. Aside from the effect of the sand on the area of the cake, the partial filtering action would alter the texture of the cake, with a resultant change in the filtrate loss.

Based on the above theory, it would be expected that the main factors that control mud loss are the pore-size distribution of the formation, and the particle-size distribution and plastering ability of the mud. Thus the mud loss should depend to some extent on any factor affecting these properties, for example the permeability of the formation, the type of mud, the temperature, and the pressure.

The little evidence to be found[1,2,3,4,5*] in the literature that might be brought to bear on the above theory is mainly of an early date and conflicting in nature. The present work supports the theory by presenting laboratory data comparing fluid losses on filter paper with those obtained on unconsolidated sands and on a few consolidated cores.[1]

The data were analyzed by plotting the cumulative fluid loss as a function of the square root of time. As shown in Fig. 1, such a curve is substantially a straight line after about the first minute. When

*References are given at end of paper.

[1]Data not yet ready for publication are being obtained to compare the effect of mud with that of mud filtrate on the oil permeability of consolidated cores containing interstitial water.

The Authors

C. M. Beeson C. C. Wright

Carrol M. Beeson worked for General Petroleum Corporation, Los Angeles, California, from 1938 to 1948, most of the time as supervisor of the production research division. Since February 1948 he has been associate professor and now is professor of petroleum engineering at University of Southern California. An active member of AIME, ACS, and API, he has served the latter as national chairman of the subcommittee on Core Analysis and Well Logging, and as a member of the executive committee of the Central Committee on Drilling and Production Practice. Beeson received his BA degree from UCLA in 1936 and PhD from Cal Tech in 1938.

Charles C. Wright is president of Oilwell Research, Inc., Long Beach, California, which he joined in January, 1949. He graduated from University of California at Los Angeles, 1941, with a degree in chemistry. After five years in the U. S. Army, he worked in the research department of A. R. Maas Chemical Company before joining Oilwell Research, Inc.

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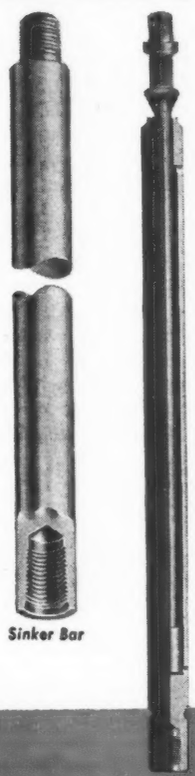

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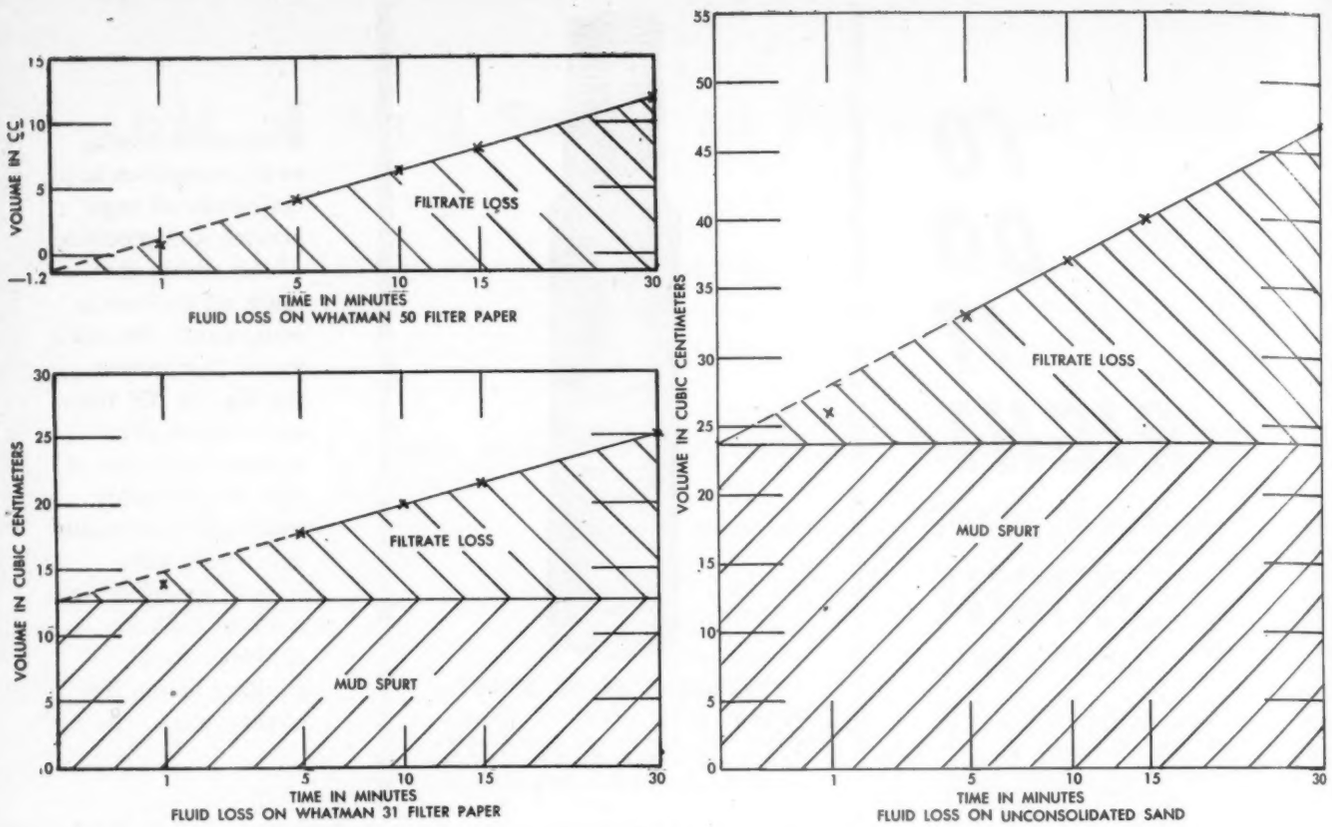


FIG. 1.

a fine filter paper such as Whatman No. 50 has been used, the extension of the line intersects the cumulative fluid-loss axis close to zero. In case a coarse filter paper or sand has been used, the intersection often is considerably above zero, indicating that the mechanism of fluid loss is extraordinary in the initial stage.

It is logical to suppose that the very rapid flow in the initial stage occurs prior to and during cake formation. Accordingly, the total fluid loss is considered as consisting of two parts which are termed the "mud spurt" and the "filtrate loss". The "mud spurt" is assumed to be the value where the straight line intersects the cumulative filtrate-loss axis. An indication of its magnitude also can be obtained from the volume reading when the rate is seen to decrease sharply. This has been characterized as the "visual mud spurt". The "filtrate loss" is obtained by subtracting the "mud spurt" from the total fluid loss. The term "filtrate ratio" is used to designate the ratio between the filtrate loss on sand and the filtrate loss on Whatman No. 50 filter paper, both being measured for the same length of time that usually is 30 minutes.

Experimental Methods

Fluid Loss on Unconsolidated Sand. The sand is extracted free of oil, dried, and saturated with the appropriate real or synthetic formation water. The wet sand is packed directly on top of the screen in a filter press[2] with the bottom plate securely fixed in position.[3] Increments of about one-quarter inch are tamped by hand with a dowel rod having a diameter about one-half that of the press.

The filter press is practically filled with the water in such manner as to disturb the bed as little as possible. An air pressure equal to that of the subsequent mud test is quickly applied to the top of the water in the press, and a volume of about 30 milliliters of water is forced through the pack. The pressure is released and this process is repeated two more times to aid in packing the sand. The pressure is then released again and the water permeability is measured at a convenient pressure.

When the level of the water reaches the top of the bed, the pressure is released again and the mud is introduced, care being exercised to minimize disturbance of the pack. The fluid loss is then carried out in the usual manner, cumulative volumes being recorded at 1, 5, 10, 15, and 30 minutes for the purposes of plotting, as described in the previous section. The volume when the rate is seen to decrease sharply is recorded as the "visual mud spurt".

The readings are corrected[4] for compression of the sand bed during the formation of the cake. This is accomplished by determining, through the

[2]It is preferable to grease the portion of the inner walls of the press that will contact the sand. Aluminum ricinoleate is suitable for tests carried out with oil-base muds or at elevated temperature.

[3]When an ordinary filter press is used, the gasket should be replaced by one that resists compression to minimize changes in the volume of the cell. In all cases, a rubber policeman should be placed on the discharge tube before releasing the pressure during the operations.

TABLE 1. Effect of filter medium.

Filter medium	Whatman No. 50		Whatman No. 31		Unconsolidated sand		
Water perm., md.	14	—	480	—	766	769	847
Vol. collected, ml							
1 min.	1.0	1.1	14	15	26	27	25
5 min.	3.9	4.0	17.5	18.0	33	35	32
10 min.	5.9	6.1	19.8	20.5	37	39	36
15 min.	7.6	7.8	21.3	22.3	40	42	39
30 min.	11.5	11.7	25.0	26.1	4	4	44
Mud collected, ml.	0	0	13	13.5	0	0	0
Visual mud spurt, ml.	0	0	12	12	13	16	13
Mud spurt, ml.	—1.2*	—1.1*	12.5	12.4	24	25	23
Filtrate loss, ml.	12.7	12.8	12.5	13.7	23	23	21
Filtrate ratio.					2.0	2.0	1.8

Note: Terms have been defined in the section "Theory of Mud Loss", and procedures have been described in "Experimental Methods".

* The negative values were due to the fact that the filter paper and screen were dry prior to the test.

[4]Attempts were made to eliminate this correction by a more complete compaction of the sand than that obtained with water pressure prior to the introduction of mud. When air pressure was transmitted directly to the top of the bed, by means of a rubber balloon, it was found that removal of the balloon disturbed the top of the sand pack. Increasing the water pressure from 100 to 150 pounds per square inch had a negligible effect upon the compaction of the two types of sands used most throughout the study, namely, Wilmington production sands and Huntington Beach production sand.

plastic barrel, the change in height of the sand bed during the fluid-loss determination. The corrections for the sands included in the paper range from 4 to 11 milliliters, with 8 milliliters being the most common value.

Fluid Loss on Consolidated Cores. The sample is drilled or cut from a core in a shape that permits accurate determination of the area of the face to be exposed to the mud. After the sample has been extracted free of oil and dried, it is mounted in a metal or plastic cylinder, and placed in the modified filter press depicted in Fig. 2.

The press has two bottom plates, the upper of which has a three-quarter inch hole in place of the usual discharge tube. The mounted sample is sealed between the two plates by means of synthetic rubber gaskets. It is then evacuated and saturated with real or synthetic formation water. In this way, the apparatus is completely filled with liquid while the core is being saturated.

After the water permeability of the core is determined in the usual manner, a graduated pipet is attached to a U-tube of Tygon hose that is filled with water. The other end of the hose is connected to the discharge tube on the bottom plate. The water level is raised to the zero point in the pipet by forcing water through the core.

The above technique increases the accuracy of subsequent measurements of fluid loss by eliminating air from the system. Accuracy also is increased by using a pipet with a volume of 1, 2, or 5 milliliters, readings of which can be estimated to the nearest 0.005, 0.01, or 0.02 milliliters, respectively.

A high degree of accuracy is advisable as a consolidated core sample usually has a much smaller cross sectional area than that of a filter press. For comparative purposes, all fluid-loss readings in this paper were multiplied by the ratio of the area of the standard filter press to that of the face of the core exposed to mud. This tends to exaggerate any error involved in the measurements. The above technique, however, yields results that are believed to be as accurate as those obtained with the standard filter press.

Mud Properties. API Code No. 29 was followed in measuring mud properties. Density was determined with a mud balance and was reported in pounds per cubic foot, as indicated by the symbol pcf. Viscosity was measured with a Stormer Viscosimeter operated at 600 revolutions per minute, and shear strengths were obtained with a Shearometer tube. Fluid losses at 60-80 F and 100 psi were determined in a standard filter press, while a press with an area of one-half that of the standard was used for higher temperatures and pressures.

Experimental Results

Filter Medium. Fluid losses usually are measured in the laboratory on Whatman No. 50 filter paper, as recommended in API Code No. 29. This filter medium has pores that are sufficiently

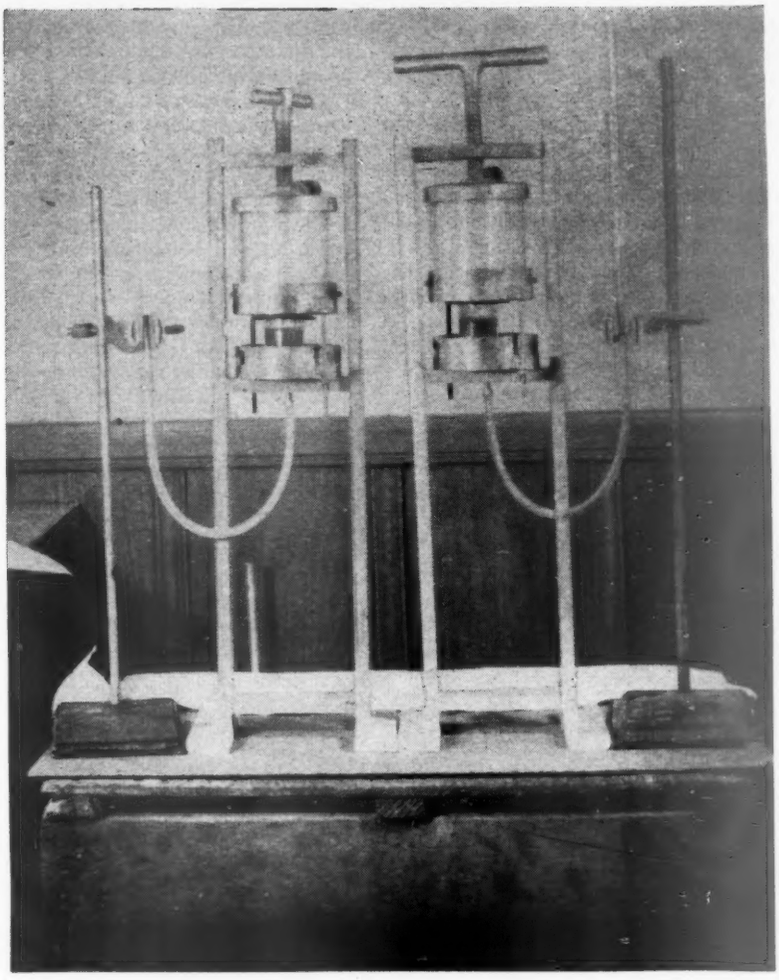


FIG. 2. Apparatus for measuring loss on consolidated cores.

TABLE 2. Effect of mud type.

Bentonite			Fluid loss on unconsolidated sand		
Density, pcf	65	Water perm., md	219	124	192
Viscosity, cp	18				
Shear, lb/100 ft²		Total fluid loss, ml	53	46	43
Initial	12	Mud spurt, ml	29.5	26	22.5
10 mins	12				
Fluid loss (API) ml	11.5	Filtrate loss, ml	23.5	20	20.5
		Filtrate ratio	2.0	1.7	1.8
Native clay					
Density, pcf	72	Water perm., md	142	260	260
Viscosity, cp	16				
Shear, lb/100 ft²		Total fluid loss, ml	15.5	16.5	20.5
Initial	60	Mud spurt, ml	4.0	2.0	6.0
10 mins	80				
Fluid loss (API) ml	11.5	Filtrate loss, ml	11.5	14.5	14.5
		Filtrate ratio	1.0	1.3	1.3
Clay water emulsion					
Density, pcf	67	Water perm, md	279	133	157
Viscosity, cp	16				
Shear, lb/100 ft²		Total fluid loss, ml	17.0	12.0	12.5
Initial	0	Mud spurt, ml	6.0	5.0	3.5
10 mins	0				
Fluid loss (API) ml	3.2	Filtrate loss, ml	11.0	7.0	9.0
		Filtrate ratio	3.4	2.2	2.8
Oil base					
Density, pcf	58	Water perm, md	299	653	
Viscosity, cp	61.4				
Shear, lb/100 ft²		Total fluid loss, ml	12.3	11.4	
Initial	0	Mud spurt, ml	9.6	8.5	
10 mins	0				
Fluid loss (API) ml	0.0	Filtrate loss, ml	2.7	2.9	
		Filtrate ratio	—	—	
Starch emulsion					
	a	b		a	b
Density, pcf	67	67	Water perm., md	804	687
Viscosity, cp	24	35			
Shear, lb/100 ft²			Total fluid loss, ml	40.5	32
Initial	0	0	Mud spurt, ml	31	25
10 mins	0	0			
Fluid loss (API) ml	0.8	0.1	Filtrate loss, ml	9.5	7
			Filtrate ratio	11.9	70

small and uniform that most usable drilling muds contain particles that bridge at practically the instant the pressure is applied. In addition the paper is so thin that there is little opportunity for an udder-like cake to form, even if bridging occurs slowly.

This is borne out by Table 1, which contains data obtained on both fine and coarse filter paper as well as on unconsolidated sand. The mud was composed of bentonite with a density of 65 lb per cubic foot, viscosity of 18 centipoises, initial, and 10 minute shear strengths of 12 and 12 lb per 100 sq ft, and a fluid loss (API) of 11.5 milliliters.

It is apparent from the table that no mud spurt occurred on the usual fine filter paper. This was not the case with the coarse filter paper, although the filtrate loss was essentially the same as the one obtained on Whatman No. 50. The sand not only permitted mud spurt, but the filtrate loss was almost twice as high as on fine filter paper.

Fig. 1 contains the fluid loss plotted against the square root of time for the first run of each group in Table 1. The "mud spurt" and "filtrate loss" also are indicated in the figure.

Type of Mud. As the particle-size distribution and plastering ability of various muds differ greatly, the type of mud would be expected to exert considerable influence on both the mud loss and the fluid loss ratio. These expectations are well supported by the results of Table 2, which were obtained with unused muds on unconsolidated sand. The temperature was in the range from 60-80 F, except in the case of the oil base mud, which was maintained at 100 F because normal viscosities are not obtainable at lower temperatures.

TABLE 3. Effect of permeability.

	Unconsolidated sand			Consolidated cores			
	Permeability range 10 — 100 md						
Air perm., md	—	—	—	90	77	60	31
Water perm., md	58	63	67	53	43	42	7
Total fluid loss, ml	48	54	62.5	15.3	20.8	12.4	17.9
Mud spurt, ml	21	26	29.5	3.0	6.5	2.5	2.3
Filtrate loss, ml	27	28	33	12.3	14.3	9.9	15.6
Filtrate ratio	2.4	2.4	2.9	1.1	1.2	0.9	1.4
	100 — 500 md						
Air perm., md	—	—	—	390	520	650	243
Water perm., md	219	124	192	171	303	469	254
Total fluid loss, ml	53	46	43	26.6	23.4	24.5	21.4
Mud spurt, ml	29.5	26	22.5	6.9	5.6	7.0	7.1
Filtrate loss, ml	23.5	20	20.5	19.7	17.8	17.5	14.3
Filtrate ratio	2.0	1.7	1.8	1.7	1.5	1.6	1.2
	500 — 1000 md						
Water perm., md	766	769	847				
Total fluid loss, ml	47	48	44				
Mud spurt, ml	24	25	23				
Filtrate loss, ml	23	23	21				
Filtrate ratio	2.0	2.0	1.8				

Note: All the consolidated cores were from one California field. The unconsolidated sand used in the low permeability range was Wilmington production sand, while Huntington Beach production sand was used for the higher permeability range.
The mud was bentonite with a density of 65.0 pcf, a viscosity of 18 cp, initial and 10-min gel strengths of 12 and 12 lb/100 ft² and a fluid loss (API) of 11.5 ml. The temperature was in the range from 60 — 80 F.

TABLE 4. Effect of temperature

		Fluid loss on unconsolidated sand		
60-80 F*		Water perm., md	279	133	157
Density, pcf	67.0				
Viscosity, cp	16	Total fluid loss, ml	17.0	12.0	12.5
Shear, lb/100 ft²		Mud spurt, ml	6.0	5.0	3.5
Initial	0				
10 mins	0	Filtrate loss, ml	11.0	7.0	9.0
Fluid loss (API) ml	3.2	Filtrate ratio	3.4	2.2	2.8
140 F		Water perm., md	124	137	
		Total fluid loss, ml	26.4	27.0	
		Mud spurt, ml	15.8	14.4	
		Filtrate loss	10.6	12.6	
170 F		Water perm., md	378	334	
		Total fluid loss, ml	30.4	36.0	
		Mud spurt, ml	19.0	24.0	
		Filtrate loss	11.4	12.0	
200 F		Water perm., md	269	291	
		Total fluid loss, ml	32.0	34.0	
		Mud spurt, ml	18.0	18.0	
		Filtrate loss	14.0	16.0	

* Mud properties were measured only at room temperature (60-80F)

TABLE 5. Effect of pressure.

Clay water emulsion mud									
Density, pcf	67.0								
Viscosity, cp	17.5								
Shear, lb/100 ft²									
Initial	0								
10 mins	0								
Fluid loss (API) ml	3.3								
Pressure		100 psi			500 psi		1000 psi		1500 psi
Water perm., md	279	133	157	60	98	82	83	89	39
Total fluid loss, ml	17	12	12.5	24.6	30.6	41	40	40.8	39.6
Mud spurt, ml	6	5	3.5	14.6	18.8	20	22	22.0	21.6
Filtrate loss, ml	11	7	9	10.0	11.8	21	18	18.8	18.0

The mud spurt for the native clay averaged 4 milliliters, while that for the starch-emulsion mud averaged 28 milliliters. The values for the other muds fell between these two, depending upon the solids content and particle-size distribution of the mud.

Permeability. As permeability is a rough measure of pore size distribution, mud spurt would be expected to correlate to some extent with this property. Table 3 contains results obtained with Wilmington core sand, listed in the order of increasing permeability range. The consolidated cores were from a California field. Unfortunately consolidated cores in the highest permeability range were unavailable.

The data indicate that the correlation is much better for consolidated cores than they are for unconsolidated sands, at least in the range from 10 to 500 millidarcys. This might be ascribed to the presence of a considerable number of large pores in each of the unconsolidated sands, due to the lack of cementing material. The fact that the mud spurts on the unconsolidated sands were much higher than those on the consolidated cores of similar permeability probably was due also to the effect of cementation on pore-size distribution.

Temperature. Temperature affects markedly many properties of drilling fluids, including particle size and plastering ability of the mud. Accordingly, this variable influences mud spurt to a considerable degree, as evidenced by Table 4 and by some of the data included in Table 6. The results of the former table were obtained with clay-water emulsion mud and Huntington Beach production sand.

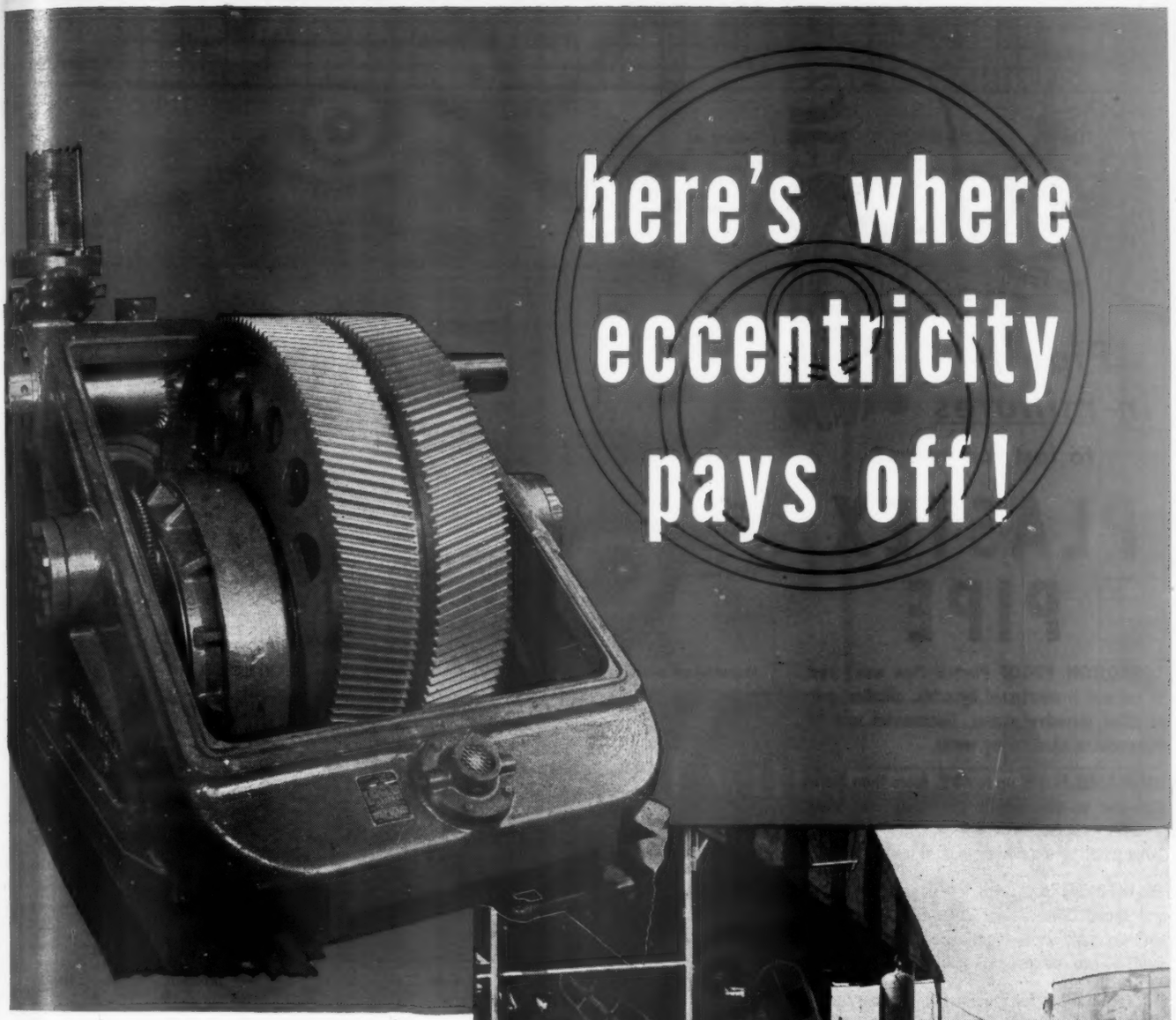
The mud in question exhibits an abnormal increase in viscosity, when heated to about 170 F. This thickening of the mud may well be obscuring the temperature effect on the bridging and plastering ability of the sample, as the mud spurt increases regularly with increasing temperature up to 170 F and then appears to decrease slightly. This mud is a clay-water-emulsion mud.

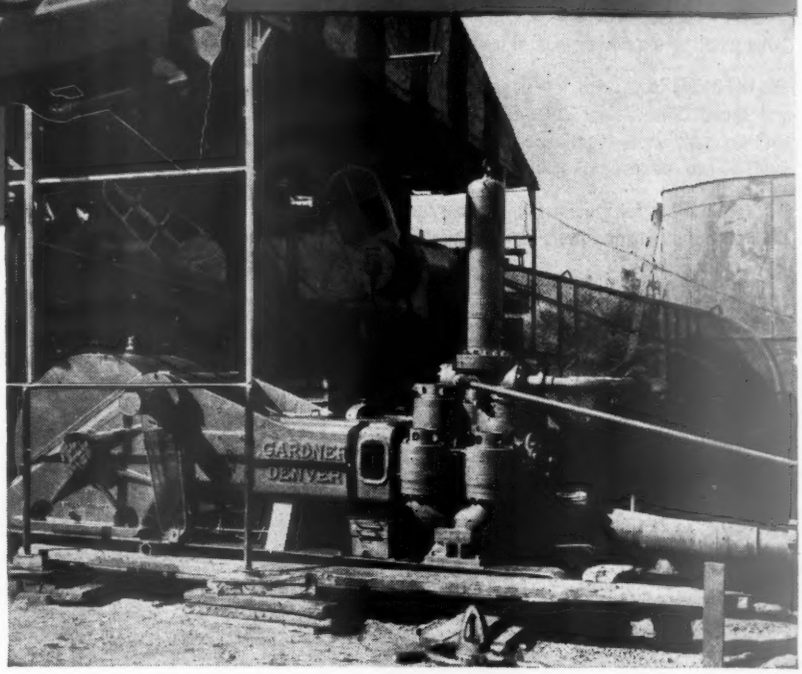
Effect of Pressure. Pressure has a decided influence on mud loss, as exemplified by Table 5, which contains data obtained with clay-water emulsion mud and Huntington Beach production sand. The increase in mud spurt, with increase in pressure, is attributed to the increase in the velocity of the mud solids at the instant of application of pressure. Of course bridging would be hindered by an increase in the velocity of the particles.

Fresh Muds Versus Hole Muds

During drilling operations various materials are incorporated into the mud. Quite often disintegration of the cuttings will supply particles with size gradation that reduces mud loss.

The improvement that may occur during use is exemplified in Table 6. Huntington Beach production sand was used throughout, except that unconsolidated Wilmington core sand was used for the starch emulsion mud. It should be noted





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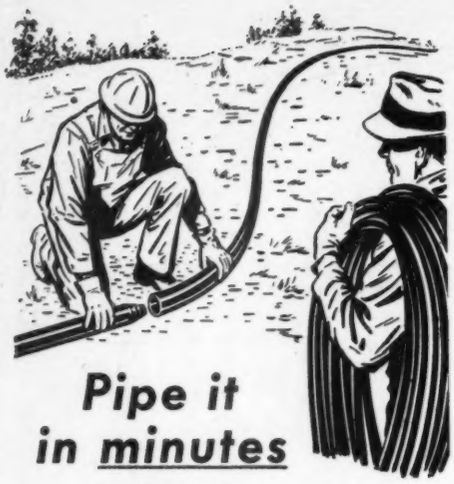

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TABLE 6. Fresh muds versus hole muds.

Clay-water emulsion at 60-80 F

	Fresh	Hole
Density, pcf	70.5	71.5
Viscosity, cp	50	50
Shear, lb/100 ft²		
Initial	6	0
10 mins.	13	9
Fluid loss, (API) ml	3.3	1.6

Fluid loss on unconsolidated sand

	Fresh	Hole
Water perm, md	727	634
Total fluid loss, ml	13.5	10.0
Mud spurt, ml	7.5	5.4
Filtrate loss, ml	6.0	4.6
Filtrate ratio	1.8	2.9

Clay-water emulsion at 200 F

	Fresh	Hole
Properties not measured		

Fluid loss on unconsolidated sand

	Fresh		Hole	
	A	B	A	B
Water perm, md	269	291	215	221
Total fluid loss, ml	32	34	13.2	14.6
Mud spurt, ml	18	18	4.0	8.6
Filtrate loss, ml	14	16	9.2	6.0

Oil base at 100 F

	Fresh	Hole
Density, pcf	58.0	65.0
Viscosity, cp	61.4	70.5
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	0	0

Fluid loss on unconsolidated sand

	Fresh		Hole	
	A	B	A	B
Water perm, md	299	653	448	487
Total fluid loss, ml	12.3	11.4	3.9	5.0
Mud spurt, ml	9.6	8.5	2.3	2.4
Filtrate loss, ml	2.7	2.9	1.6	2.6

Oil base at 200 F

	Fresh		Hole	
	A	B	A	B
Properties not measured				
Water perm., md	105	118	557	280
Total fluid loss, ml	13.6	15.8	27.2	21.0
Mud spurt, ml	12.2	14.4	20.4	17.8
Filtrate loss, ml	1.4	1.4	6.8	3.2

Starch emulsion at 60-80 F

	Fresh		Hole
	A	B	
Density, pcf	67.0	67.0	71.0
Viscosity, cp	24	35	42
Shear, lb/100 ft²			
Initial	0		
10 mins.	0		
Fluid loss (API) ml	0.8	0.1	5.2

Fluid loss on unconsolidated sand

	Fresh		Hole
	A	B	
Water perm., md	804	687	349
Total fluid loss, ml	40.5	32	11.5
Mud spurt, ml	31	25	8.0
Filtrate loss, ml	9.5	7	3.5
Filtrate ratio	11.9	70	0.7

Starch emulsion at 200 F

	Fresh	Hole
Density, pcf	—	—
Viscosity, cp	14	18
Shear, lb/100 ft²		
Initial	0	3.5
10 mins.	0	4.8
Fluid loss (API) ml	—	—

Fluid loss on unconsolidated sand

	Fresh		Hole	
	A	B	A	B
Water perm., md	218	210	209	222
Total fluid loss, ml	230	190	59	58
Mud spurt, ml	164	110	10	9
Filtrate loss, ml	66	80	49	49

Oil base at 100 F

	Fresh	Hole
Density, pcf	58.0	65.0
Viscosity, cp	61.4	70.5
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	0	0

Fluid loss on consolidated cores

	Fresh	Hole
Air perm., md	53	62
Water perm., md	11	63
Total fluid loss, ml	30.3	8.1
Mud spurt, ml	28 0	5.5
Filtrate loss, ml	2.3	2.6

Starch emulsion at 60-80 F

	Fresh	Hole
Density, pcf	67	71
Viscosity, cp	24	42
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	0.8	1.6

Fluid loss on consolidated cores

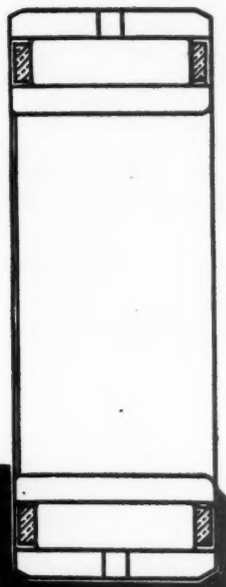
	Fresh	Hole
Air perm., md	319	320
Water perm., md	153	210
Total fluid loss, ml	7.2	4.1
Mud spurt, ml	3.9	2.1
Filtrate loss, ml	3.3	2.0
Filtrate ratio	4.1	1.3

that the extremely high mud spurts obtained with this mud at 200 F were due undoubtedly to the fact that the emulsion broke at that temperature, as evidenced by the separation of oil and water; likewise, at 200 F the oil base showed evidence of separation of components.

Controlling Loss With Additives

Although the mud spurts are usually much lower with hole muds than with fresh muds, the values are still appreciable. In addition, drilling operations can not be depended upon to furnish solids of the proper particle-size distribution.

Accordingly several commercially available materials were tested as possible mud-spurt reducers, as shown in Table 7. Bentonite mud, treated with 10 lb per barrel of the additive, and Hunt-



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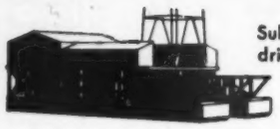

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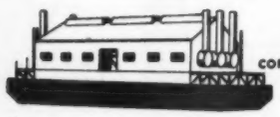

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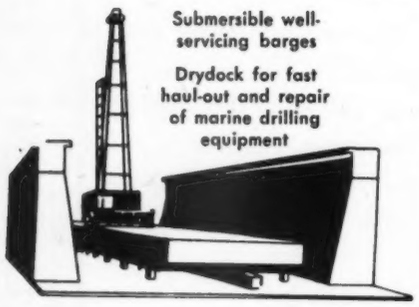

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TABLE 7. Comparison of additives for mud spurt reduction.

Additive	None			A		B	
Density, pcf	65.0			—		—	
Viscosity, cp	18			25		25	
Shear, lb/100 ft²							
Initial	12			12		12	
10 mins.	12			12		12	
Fluid loss (API) ml.	11.5			10.5		11.5	
Water perm., md.	219	124	192	122	88	80	105
Total fluid loss, ml.	53	46	43	36	32	33	33
Mud spurt, ml.	29.5	26	22.5	15	15	12	13
Filtrate loss, ml.	23.5	20	20.5	21	17	21	20
Filtrate ratio	2.0	1.7	1.8	2.0	1.6	1.8	1.7

Additive	C			D			
Density, pcf	—			—			
Viscosity, cp	25			21			
Shear, lb/100 ft²							
Initial	12			10			
10 mins.	12			10			
Fluid loss (API) ml.	11.3			11.0			
Water perm., md.	94	87	142	138			
Total fluid loss, ml.	25	29	32	27			
Mud spurt, ml.	6	10	14	12			
Filtrate loss, ml.	19	19	18	15			
Filtrate ratio	1.7	1.7	1.6	1.4			

TABLE 8. Controlling mud loss from fresh and hole muds.

Fresh clay water emulsion mud at 60-80 F

	Blank	Additive A 5 lb/bbl
Density, pcf	70.5	—
Viscosity, cp	50	55
Shear, lb/100 ft²		
Initial	6	15
10 mins.	13	23
Fluid loss (API) ml.	3.3	2.6

Fluid loss on unconsolidated sand

	Blank	Additive A 5 lb/bbl
Water perm., md.	727	738
Total fluid loss, ml.	13.5	11.5
Mud spurt, ml.	7.5	6.0
Filtrate loss, ml.	6.0	5.5
Filtrate ratio	1.8	2.1
Per cent mud spurt reduction		20%

Used clay water emulsion mud at 60-80 F

	Blank	Additive A 5 lb/bbl
Density, pcf	71.5	—
Viscosity, cp	50	54
Shear, lb/100 ft²		
Initial	0	3
10 mins.	9	10
Fluid loss (API) ml.	1.6	1.4

Fluid loss on unconsolidated sand

	Blank	Additive A 5 lb/bbl
Water perm., md.	634	633
Total fluid loss, ml.	10.0	9.5
Mud spurt, ml.	5.4	4.8
Filtrate loss, ml.	4.6	4.7
Filtrate ratio	2.9	3.4
Per cent mud spurt reduction		11%

Fresh clay water emulsion mud at 170 F

Fluid loss on unconsolidated sand

	Blank		Additive A 5 lb/bbl	
Water perm, md.	378	334	311	368
Total fluid loss, ml.	30	36.0	18.2	17.8
Mud spurt, ml.	19	24.0	7.6	5.0
Filtrate loss, ml.	11	12.0	10.6	12.8
Avg. % mud spurt red.		71%		

Fresh clay water emulsion mud at 200 F

	Blank	Additive A 5 lb/bbl
Density, pcf	—	—
Viscosity, cp	66	72
Shear, lb/100 ft²		
Initial	15	16
10 mins.	27	35
Fluid loss (API) ml.		

Fluid loss on unconsolidated sand

	Blank		Additive A 5 lb/bbl	
Water perm., md.	269	291	222	235
Total fluid loss, ml.	32	34	28	26
Mud spurt, ml.	18	18	13	11
Filtrate loss, ml.	14	16	15	15
Avg. % mud spurt red.		33%		

Used clay water emulsion mud at 200 F

	Blank	Additive A 5 lb/bbl
Density, pcf	—	—
Viscosity, cp	39.5	42.5
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml.	—	—

Fluid loss on unconsolidated sand

	Blank		Additive A 5 lb/bbl	
Water perm., md.	215	221	206	202
Total fluid loss, ml.	13.2	14.6	9.8	11.0
Mud spurt, ml.	4.0	8.6	2.8	4.4
Filtrate loss, ml.	9.2	6.0	7.0	6.6
Avg. % mud spurt red.		43%		

Fresh oil base mud at 100 F

	Blank	Additive A 5 lb/bbl
Density, pcf	58	—
Viscosity, cp	61	61
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml.	0	0

Fluid loss on unconsolidated sand

	Blank		Additive A 5 lb/bbl	
Water perm., md.	299	653	259	451
Total fluid loss, ml.	12.3	11.4	3.5	3.4
Mud spurt, ml.	9.6	8.5	1.4	1.8
Filtrate loss, ml.	2.7	2.9	2.1	1.6
Avg. % mud spurt red.		82%		

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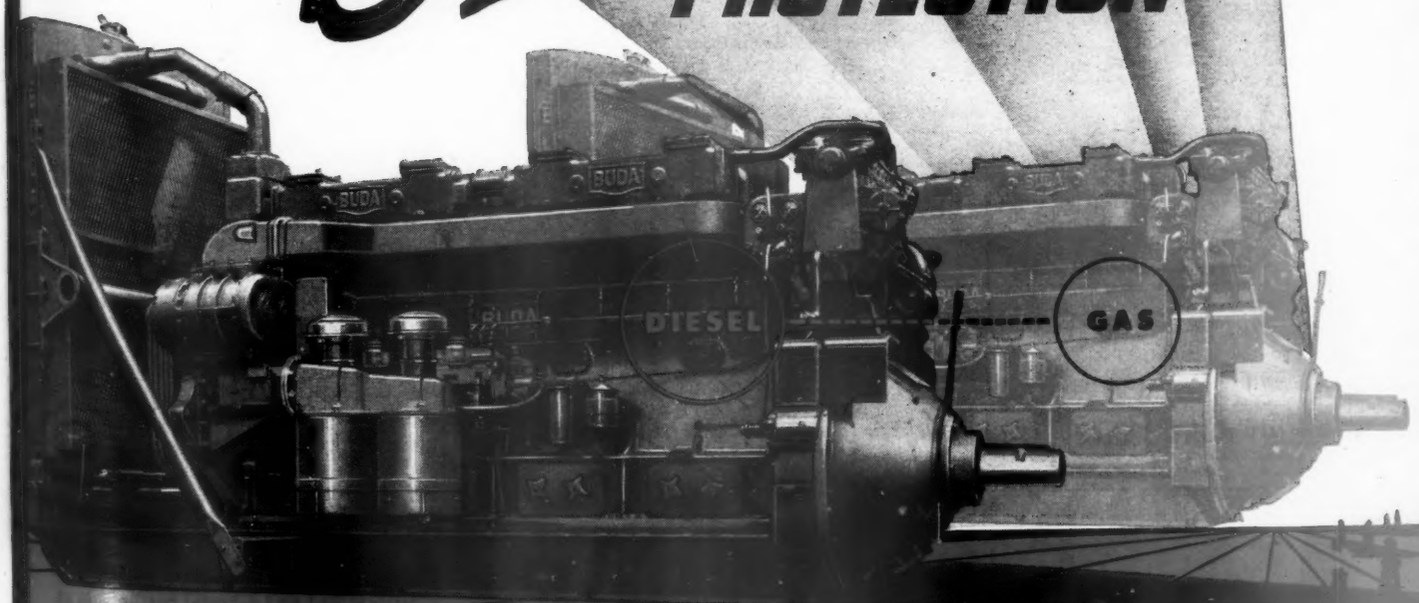

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TABLE 8. Controlling mud loss from fresh and hole muds. (Continued)

Used oil base mud at 100 F

	Blank	Additive A 5 lb/bbl
Density, pcf	65	—
Viscosity, cp	70	71
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	0	0

Fluid loss on unconsolidated sand

	Blank		Additive A 5 lb/bbl	
Water perm., md	448	487	448	489
Total fluid loss, ml	3.9	5.0	2.4	3.5
Mud spurt, ml	2.3	2.4	0.8	1.1
Filtrate loss, ml	1.6	2.6	1.6	2.4
Avg. % mud spurt red.		62%		

Used oil base mud at 200 F

Properties not measured

Fluid loss on unconsolidated sand

	Blank		Additive A 5 lb/bbl	
Water perm., md	557	280	404	466
Total fluid loss, ml	27.2	21.0	7.0	10.2
Mud spurt, ml	20.4	17.8	5.4	5.0
Filtrate loss, ml	6.8	3.2	1.6	5.2
Avg. % mud spurt red.		73%		

Fresh starch emulsion mud at 60-80 F

	Blank	Additive A 5 lb/bbl
Density, pcf	67	—
Viscosity, cp	24	26
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	0.8	0.5

Fluid loss on unconsolidated sand

	Blank	Additive A 5 lb/bbl
Water perm., md	804	728
Total fluid loss, ml	40.5	28.0
Mud spurt, ml	31.0	20.5
Filtrate loss, ml	9.5	7.5
Filtrate ratio	11.9	15
Per cent mud spurt reduction	34%	

Used starch emulsion mud at 60-80 F

	Blank	Additive A 5 lb/bbl
Density, pcf	71	—
Viscosity, cp	42	44
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	5.2	4.9

Fluid loss on unconsolidated sand

	Blank	Additive A 5 lb/bbl
Water perm., md	349	348
Total fluid loss, ml	11.5	10.0
Mud spurt, ml	8.0	7.0
Filtrate loss, ml	3.5	3.0
Filtrate ratio	0.7	0.6
Per cent mud spurt reduction	13%	

Fresh starch emulsion mud at 200 F

	Blank	Additive A 5 lb/bbl
Density, pcf	—	—
Viscosity, cp	14	16
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	—	—

Fluid loss on unconsolidated sand

	Blank		Additive A 5 lb/bbl	
Water perm., md	218	210	269	229
Total fluid loss, ml	230	190	116	106
Mud spurt, ml	164	110	36	34
Filtrate loss, ml	66	80	80	72
Avg. % mud spurt red.		74%		

Used starch emulsion mud at 200 F

	Blank	Additive A 5 lb/bbl
Density, pcf	—	—
Viscosity, cp	18	32
Shear, lb/100 ft²		
Initial	3.5	6.0
10 mins.	4.9	12
Fluid loss (API) ml	—	—

Fluid loss on unconsolidated sand

	Blank		Additive A 5 lb/bbl	
Water perm., md	209	222	242	243
Total fluid loss, ml	59	58	45	46
Mud spurt, ml	10	9	4	2
Filtrate loss, ml	49	49	41	44
Avg. % mud spurt red.		68%		

Fresh oil base at 100 F

	Blank	Additive A 5 lb/bbl
Density, pcf	58.0	—
Viscosity, cp	61	61
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	0	0

Fluid loss on consolidated cores

	Blank	Additive A 5 lb/bbl
Air perm., md	53	72
Water perm., md	11	13
Total fluid loss, ml	30.3	16.7
Mud spurt, ml	28.0	13.5
Filtrate loss, ml	2.3	3.2
Per cent mud spurt reduction	52%	

Used oil base at 100 F

	Blank	Additive A 5 lb/bbl
Density, pcf	65	—
Viscosity, cp	70.5	71
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	0	0

Fluid loss on consolidated cores

	Blank	Additive A 5 lb/bbl
Air perm., md	62	61
Water perm., md	63	65
Total fluid loss, ml	8.1	7.2
Mud spurt, ml	5.5	4.8
Filtrate loss, ml	2.6	2.4
Per cent mud spurt reduction	13%	

Fresh starch emulsion mud at 60-80 F

	Blank	Additive A 5 lb/bbl
Density, pcf	67	—
Viscosity, cp	24	26
Shear, lb/100 ft²		
Initial	0	0
10 mins.	0	0
Fluid loss (API) ml	0.8	0.5

Fluid losses on consolidated cores

	Blank	Additive A 5 lb/bbl
Air perm., md	319	313
Water perm., md	153	157
Total fluid loss, ml	7.2	7.1
Mud spurt, ml	3.9	2.7
Filtrate loss, ml	3.3	4.4
Filtrate ratio	4.1	8.8
Per cent mud spurt reduction	31%	

ington Beach production sand were used throughout.

It is evident from the table that the additives appreciably reduced the mud spurt and, to a lesser extent, the filtrate loss. This indicates the advisability of adding such materials to the mud, for the purpose of insuring an appropriate particle-size gradation.

Stronger evidence of the effectiveness of mud-spurt reducers was obtained by testing additive A* on both fresh and hole muds, as listed in Table 8. The treatment was maintained at five pounds per barrel throughout. Three types of completion muds were used and determinations were made on both unconsolidated sand and consolidated cores. The former was Huntington Beach Production sand, while the latter were from another California field.

Additive A was chosen, for the reason that it will not effect the mud weight, will pass through conventional shaker screens, and is commercially available for treating drilling fluids.

The data show that the additive not only reduces mud spurt and filtrate loss from fresh completion muds, but it has a similar effect upon the hole muds most of which had been used in drilling for about 72 hours.

Conclusion

The differences between the fluid loss on fine filter paper and on sand indicate that mud particles enter the pore channels prior to and during formation of the cake in the sand. This also gives rise to a filtrate loss, after bridging of the pore channels has occurred, that is higher than that measured on fine filter paper.

These observations point toward the advisability of a thorough consideration of mud loss. Appreciable reductions in the mud spurts and to a lesser extent the filtrate losses, as obtained by adding commercially available products to both fresh and hole muds, makes attractive the use of additives to control this possible source of damage to subsequent production.

Acknowledgments

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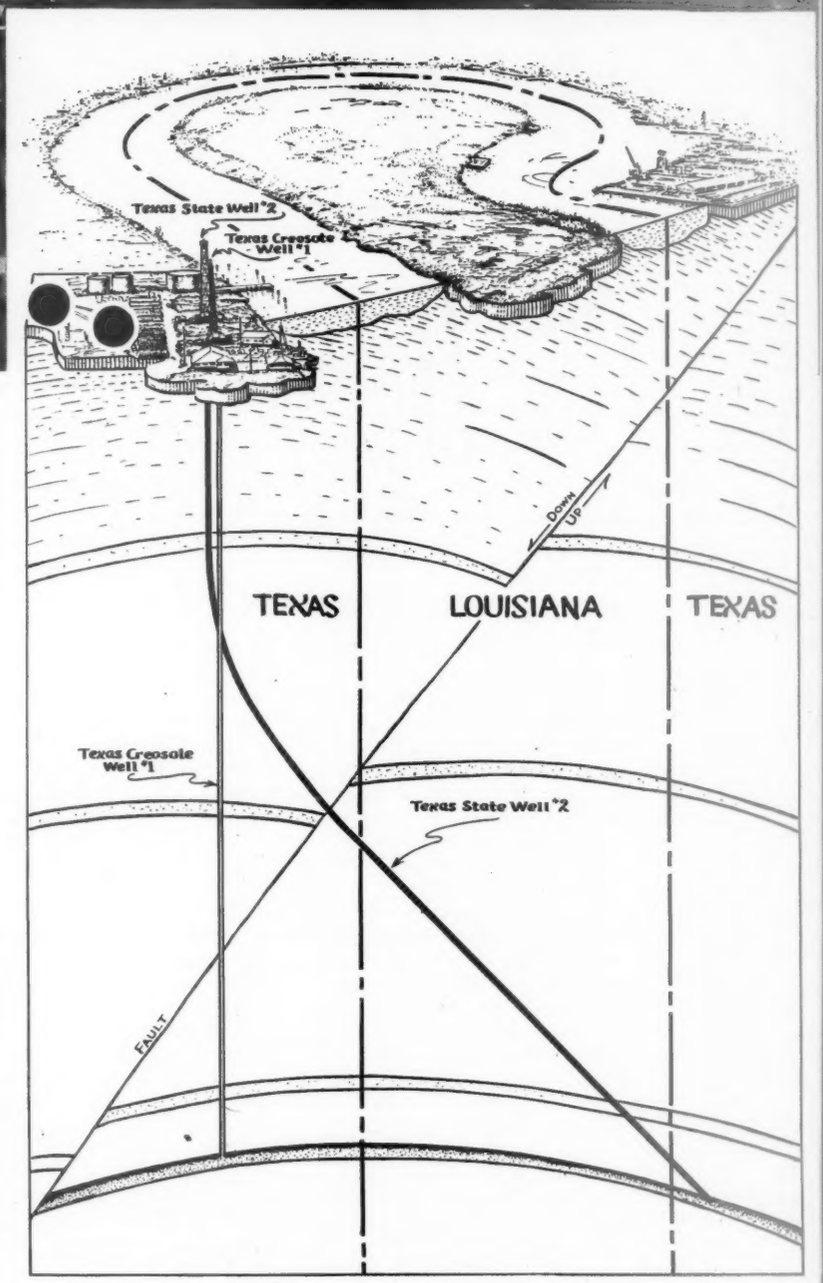
References

1. R. A. Silent: "Circulation Losses", *API Drill. & Prod. Pract.* (1936) 60.
2. W. N. Arnquist: "Note on the Filtering Action of Porous Media", *J. Appl. Phys.* (1937) 8 (5), 363.
3. H. T. Byck: "The Effect of Formation Permeability on the Plastering Behavior of Mud Fluids", *API Drill. & Prod. Pract.* (1940) 40.
4. C. M. Beeson: "Well Completion Practices", *World Oil* (1949) 129, (9) 114.
5. T. J. Nowak and R. F. Krueger: "The Effect of Mud Filtrates and Mud Particles Upon the Permeability of Cores", paper presented at Los Angeles API meeting, May 11, 1951.

* * *

*Mud spurt reducer known commercially as Silvacon 100, manufactured by Weyerhaeuser Timber Company, Longview, Washington.



TEXAS TO TEXAS VIA LOUISIANA†

Ohio Oilers at Phoenix Lake use controlled directional drilling to lick tough problem

FORMING the east-west boundary between Texas and Louisiana is the meandering Sabine River. Immediately southeast of Orange, Texas, the Sabine makes a double hairpin turn. Here Texas and Louisiana lands dovetail like pieces of a jig saw puzzle. A part of the southwestern end of the Phoenix Lake structure underlies this bend.

The Ohio Oil Company holds among other Phoenix Lake acreage Texas State River Lease 36027 covering the Texas side of the Sabine as it makes this oxbow

†Reprinted from *The Beacon*, employee magazine, personnel department, The Ohio Oil Company. Author is Robert L. Hazlett, *The Beacon* editor; photos by A. W. Stewart, supervisor of personnel for the Terre Haute division (recently transferred from Shreveport, Louisiana), and diagrams by F. I. Gardner, *The Beacon* artist.

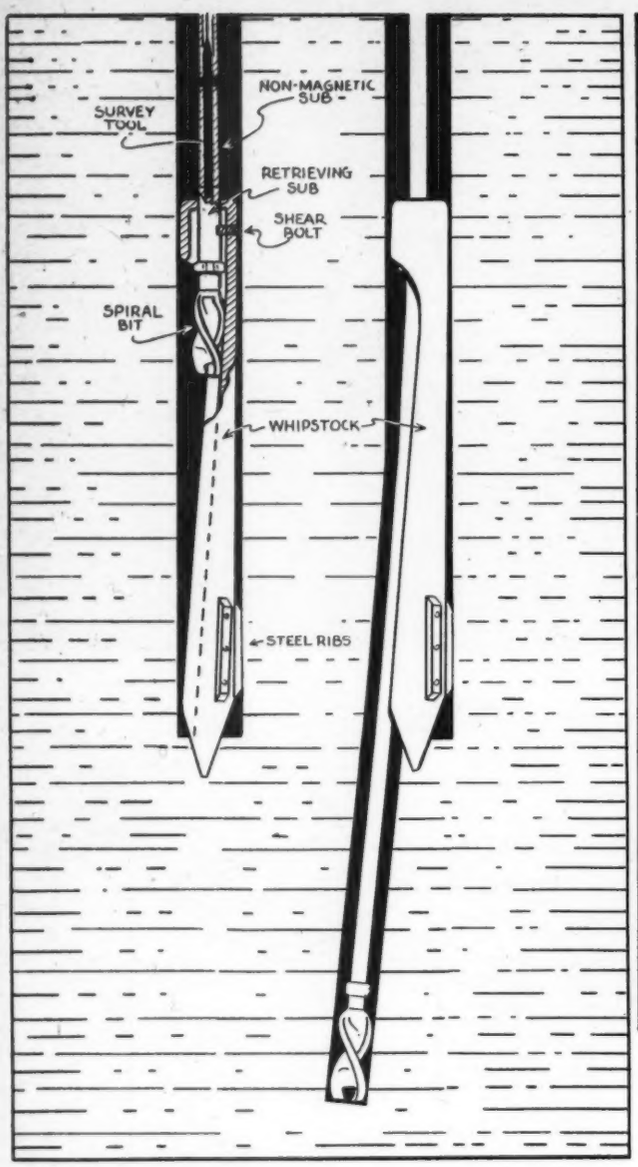


FIG. 2. Whipstock.

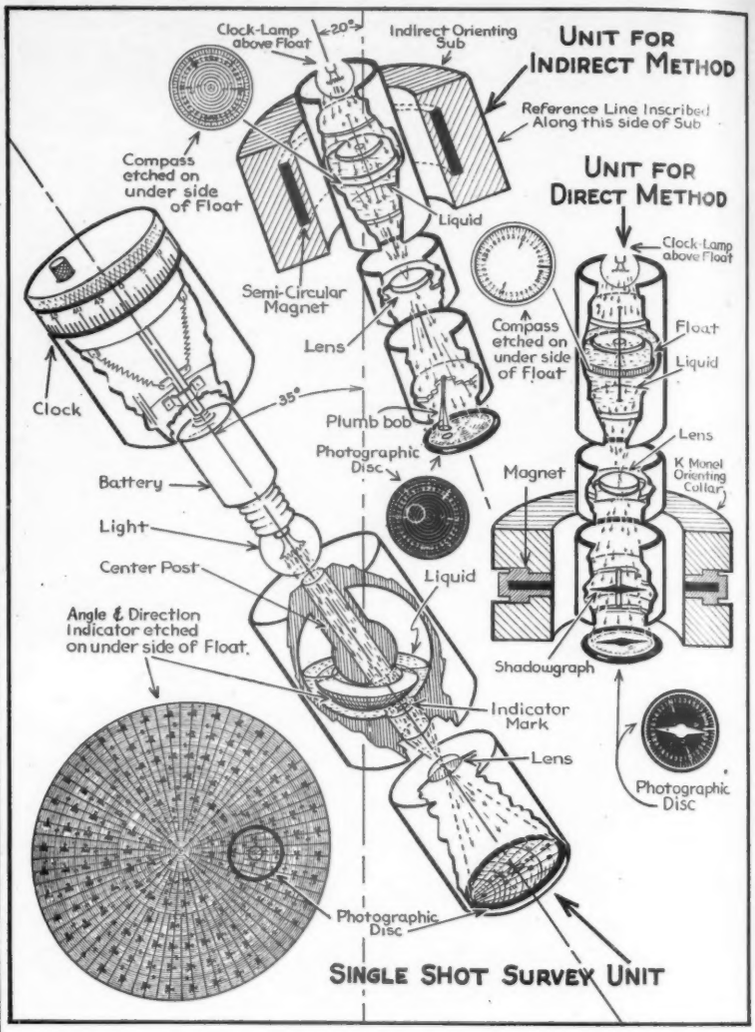


FIG. 3. Items in single shot survey unit.

bend. The state of Texas requires that surface location of wells producing oil from Texas reservoirs must be within the state's boundaries. Platform or barge drilling in the river was not feasible. Shipyards and other heavy industries line the west bank of the Sabine on the outskirts of Orange. The only available drill site was our own Creosote Fee land nearly a half mile across the bend from the Texas State River Lease.

So, from a surface location on our Creosote fee acreage within Texas, our company started No. 2 Texas State, drilled under the river, under Louisiana, again below the river, bottoming the hole on the Texas side of the Sabine, covered by State River Lease 36027.

The well completed for 67 bbl of 47-deg oil and 750,000 cu ft of natural gas daily. Total hole drilled is 8528 ft. Through the amazing technique of controlled directional drilling, lateral distance of the bottom of the hole is 2530 ft north, 13 deg, 9 min, 19 sec east from where the hole spudded.

For the first 700 ft, No. 2 Texas State was drilled vertically like any routine rotary hole. Then controlled directional drilling started. Whipstock was run to the bottom of the hole. The whipstock is a long channel-shaped piece of steel with a collar at its top (see Fig. 2) through which the subs and drill pipe can pass. The whipstock is pointed on the bottom end. The channel face of the whipstock sets at an angle to deflect the bit.

The whipstock assembly is made up on the derrick floor. Directional drilling instruments, tools, and service* were employed for our No. 2 Texas State. Bit is made up (screwed into) a retrieving sub, and the free end of the sub is passed through the collar of the whipstock. A K-Monel metal (non-magnetic) orienting collar is then made up on the free end of the retrieving sub. A shear bolt passes through the collar of the whipstock into the retrieving sub so that whipstock will turn with the drilling string. This whipstock assembly is then lowered to bottom in the conventional manner by adding sections of drill pipe.

With the whipstock on bottom it is necessary to face the whipstock in the direction in which the hole is to be slanted. Two orientation methods are used: The direct method when the slant of the hole off vertical does not exceed 12 deg. The indirect method when the existing angle is more than 12 deg. In our No. 2 Texas State the direct method was used at 700, 735, and 1049 ft; while whipstock was oriented by the indirect method at 1941, 5386, 6860, 7830, 8095, and 8209 ft.

*Houston Oil Field Materials Company.

Direct Method

In the non-magnetic orienting collar (Fig. 3) are two small magnets. When the orienting collar, retrieving sub, and whipstock are made up, the relative azimuth (compass degrees) position between the north attracting magnet in the orienting collar and the face of the deflecting tool is measured and noted. Then with whipstock on bottom and circulation established, the survey instrument is run.

The survey instrument consists of a water-tight, light-tight metal case. In the top of the case is a clock (see diagram) which is set for a pre-determined time to flash the light bulb. In the lower sec-

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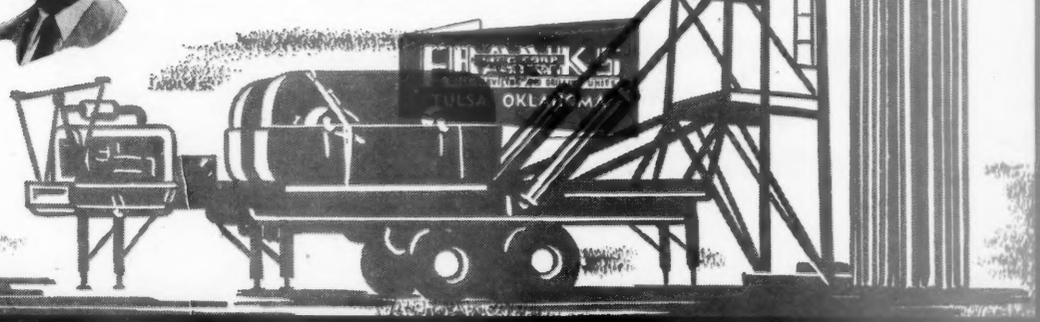

tion of the case is seated a sensitized paper disc. In the center of the case go one of three interchangeable units.

Unit for the direct method is composed of a transparent nylon disc compass floating in liquid, then a lens followed by the shadowgraph (magnetic needle). With the direct unit made up in the survey instrument, the instrument is run on a wire line down through the drill pipe. The instrument case will seat on a collar so placed in the orienting collar that the shadowgraph needle in the instrument will be exactly in a plane with the magnets in the orienting collar. These magnets will lock the shadowgraph, so that the black-dot-marked end of the needle points to the north magnet in the collar. Thus, the shadowgraph needle in the instrument gives a reference point to the face of the whipstock attached to the sub and collar. Meanwhile, the floating disc compass aligns itself with the magnetic field of the earth. The clock has been set to allow ample time for the survey tool to be run and seated. The clock flashes the light to throw a picture on the photo disc, which shows the position of the shadowgraph needle on the compass face. Then from the photo disc it can be readily determined which way the whipstock is facing and how many degrees to turn the whipstock to face it in the desired direction.

With the whipstock turned in the correct direction, weight is put on the drilling string to force the pointed end of the whipstock into the bottom of the hole and secure it in position. Then more weight is added to shear the pin which linked the whipstock to the retrieving sub, thus freeing the bit and drilling string to slide down the channelled face of the whipstock. With the bit on bottom drilling is started, making new hole in the desired direction. When the drilling string is pulled the outside collar on the retrieving sub engages the collar on the whipstock and carries the whipstock up and out of the hole.

Indirect Method

In the indirect method the survey instrument is made up with the single shot unit and is run in open hole. The interchangeable single shot unit is composed of a light transmitting post, which centers in a transparent spherical container. On the exact center at the bottom of this container is inscribed a small circle with cross hairs. The spherical container holds a liquid and in this liquid floats a transparent half-sphere with magnets in it. Surface tension of the liquid between the inner edge of the float and the knob-like center post keeps the float centered at all times. Inscribed on the transparent float are concentric circles like lines of latitude on the globe, and lines radiating from the center like lines of longitude. With the instrument run in a slanting hole, this transparent miniature half-globe floats level with the liquid. At the same time the magnets on the float keep it turned toward magnetic north.

When the clock trips the flash, the beam of light passes through that portion of the floating angle compass over the cross hair circle inscribed on the transparent container and throws this combined image on the sensitized photo disc. On the picture thus obtained, the circle on which the cross hairs intersect gives the angle reading of the hole off vertical. The line from center to circumference of circle intersected by the cross-hairs gives the compass direction of the slant of the hole.

After this picture is obtained, the whipstock assembly is lowered to bottom and the survey tool with the indirect unit is run. This unit consists of a transparent floating disc compass, followed by a lens, then a plumb bob hung by wire lines from the center of the unit. Below the plumb bob is the photo disc. For this run, the compass is so placed that with the instrument seated in the orienting sub, the compass will be pulled with its north marking attracted to the north pole of the magnet in the sub. The plumb bob will fall vertical. The timing device flashes the light and the photo disc takes the image of the plumb bob as it falls on the locked compass. Then by comparing this picture with that photo disc showing the direction which the hole slants (previously taken with the single shot instrument in the open hole) the direction which the whipstock is facing can be readily determined. The whipstock face is then turned in the desired direction and drilling proceeds.

* * *

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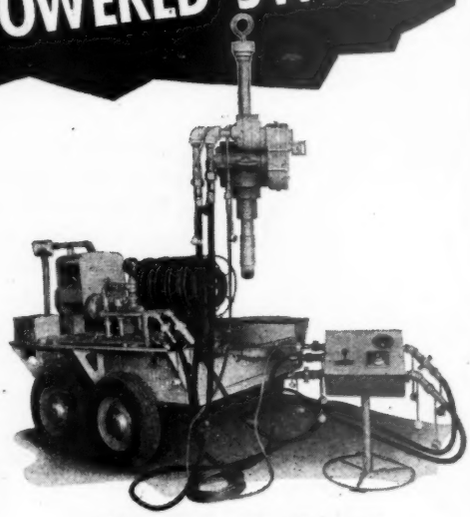

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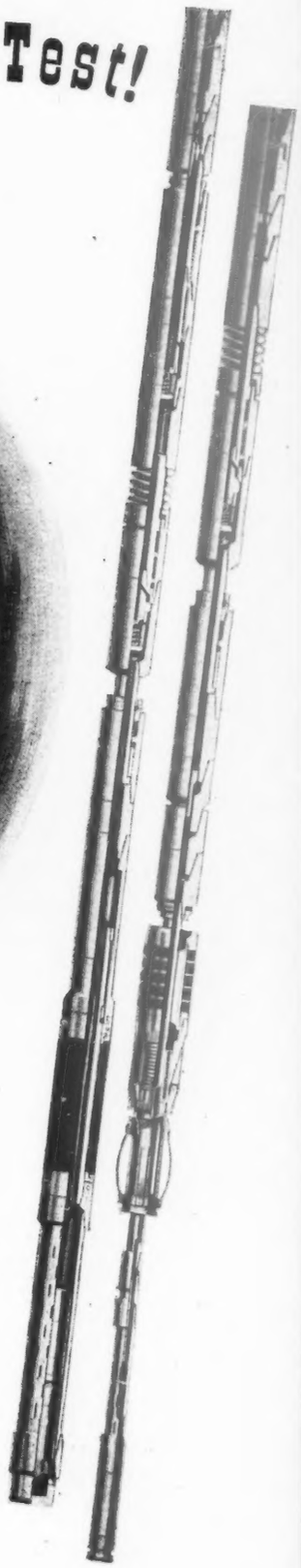

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Photogeology in the Williston Basin

New techniques for structure and outcrop mapping have been developed in exploration of a great new area of promise

LOUIS DESJARDINS*

ABOUT 15 counties in the North Dakota and Montana portions of the Williston Basin are proving to be mappable in practically complete detail by photogeology, and several more counties, where the glacial drift becomes thicker, are mappable with varying degrees of incompleteness. This type of exploration includes both the mapping for formational outcrops and the providing of structural contours to an accurately measured contour interval. All this is derived from the photo analysis unassisted by field work; but with a comparatively small amount of such work the accepted formational boundaries can be determined, and the contours fitted to a key bed and to sea level datum.

Economical

This completeness of photogeology in the Williston Basin puts the method in first place in the economy of exploring this area. Even though photogeology is limited to surface mapping rather than subsurface, a knowledge of the surface structure in this area is accepted as being of great value, since the oil discoveries already made are practically all related to structures well shown at the surface. The method has the great advantage of speed and low cost. It is suitable for the rapid mapping of blocks of large dimension, even whole counties at a time. Yet, it should not be regarded as mere reconnaissance, as the amount of detail, well shown in the accompanying figures, far exceeds what could ever be economically derived from field work.

To be able to attain this success from photogeology in the Williston Basin has placed special demands upon its techniques usually not necessary in other regions. Some of the structural contouring techniques used were first worked out here to meet its special problems. They include some advances not yet published, and which are herein briefly described for the first time.

Bedding Outcrop

The peculiar problems of the Williston Basin are twofold. The first affecting the outcrop interpretation, relates to the nature of the bedding in association with the very rough and ramified topography, often of the badland type. The bedding is characterized by a lack of thick homogeneous units, and the occurrence of a vast number of thin hard beds scattered through the softer material. The problem to the photogeologist is to map a close selection of the individual layers with unusual precision so as to avoid "jumping beds" and insure that all mapped horizons are carried correctly over long distances. It is essential to measure frequent columnar sections to scale (by photogrammetric measurement) of all the beds being carried. The comparison of these columns aids in establishing exact correlations across broad valleys or areas of modified topography. This painstaking work may seem very slow from this description, but an experienced photogeologist performs such work quite rapidly. It is a minimum requirement to meet this problem of the Williston Basin.

Structural Contours

The other special problem relates to the structural contouring, and is caused by the near horizontality of the bedding planes in a topographic setting relatively lacking in reliable natural indications of true horizontality. The goal in this situation is to provide reliable contours in the absence of supplied elevations. It is worthwhile to discuss the method for this in more detail.

In a recent published article[1], the writer has described in considerable detail several photogrammetric methods for structural contouring with and without furnished field elevations. (Any method can utilize such elevations when available.) While the mathematics of the photos provides an accurate vertical measure for the contour interval, the chief difficulty is the horizontal datum control. This depends on control by simple topographic elements, such as that all streams must flow down hill, combined with geometric properties of the stereo photos that allow any horizontal plane that is set up to be projected indefinitely. It is possible to provide a visible artificial horizontal plane in the stereo picture, by means of a series of "floating lines" and to adjust the position of this plane at will. Furthermore, it is possible to move this series of lines or grid in such a way that the horizontal plane appears to rise and fall parallel to itself as seen in the three dimensional view of the topography. Finally, this motion is attached to a measuring scale to translate its movement into feet of elevation.

Method

The technique as applied to the Williston Basin is merely a modification and improvement over those described in the article cited above. The equipment for providing the grid of floating lines consists of a film sheet containing engraved lines, the measured scale, and two slots for pins which permit motion parallel to the photo flight line and at right angles to the lines. This is placed over one of the photos, while to the other photo there is fastened a series of individual narrow film strips, each containing a single engraved line. The adjustment to horizontality is made by setting these individual strips, but this is greatly aided by sliding the opposite sheet so that the apparent floating lines can be brought to any desired topographic level and checked against stream gradients, etc. The absolute straightness of the lines insures the projections of horizontality, wherever established, in the direction of the lines, while the ease of placing several adjacent lines in a single plane, floating in space, insures their projections at right angles. After the adjustment is completed, a transparent overlay is fastened over the photo containing the individual strips, thus protecting them from accidental movement that might destroy their adjustment. The structural contours are drawn on this overlay, for which operation the floating grid is raised or lowered, as desired, to intersect with any outcropping bed at any place, and the interval between contours is determined by readings of the scale.

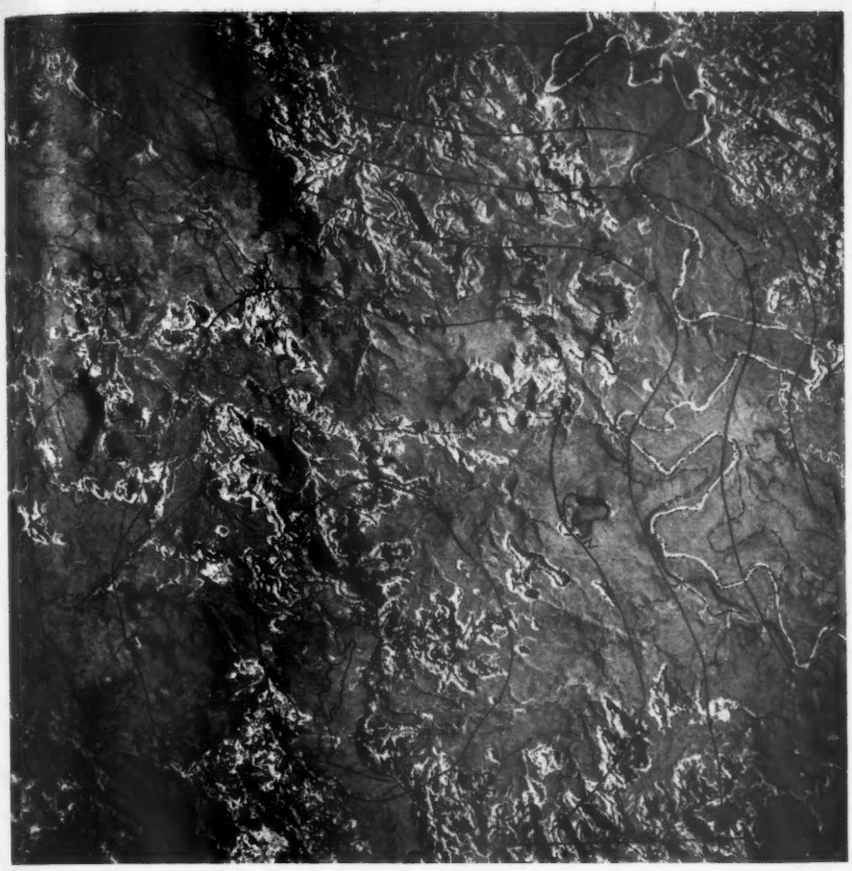
Accuracy

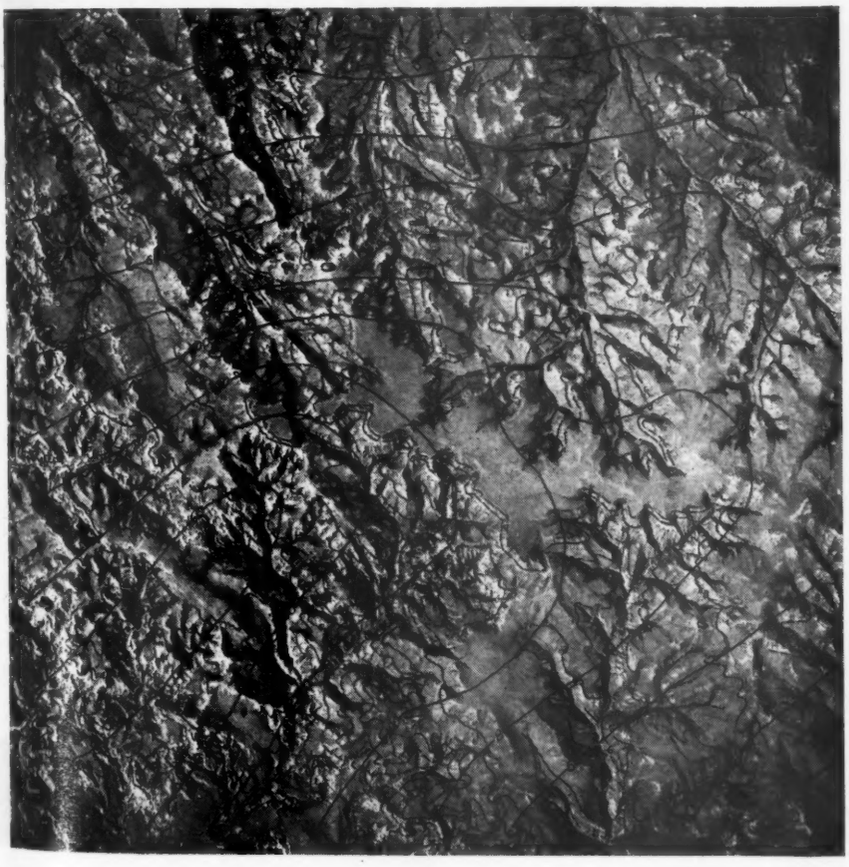
There is an ample automatic check to prove the accuracy of these contours. This is the fact that when they are carried progressively from one stereo pair setup to the next as these overlap each other, it is found that they fit the new grid each time with great accuracy. This means that large areas regardless of size are completed at once with a single set of contours, and it also proves that

*Louis Desjardins Photogeological Services, Houston, Texas.

[1]Desjardins, Louis, "Structural Contouring for the Photogeologist," Photogrammetric Engineering, Dec. 1950, pp. 784-796.

EXCLUSIVE





Scale: 1 MILE

These photos are both from Dawson County, Montana, and are typical of the Williston Basin. The annotations include fine dashed lines, numbered, of bedding outcrops, and structural contours having a 20-ft interval. Selected to show typical anticlinal structures, of which very many are revealed by photogeology.

the adjustments to "interpreted" horizontality in the absence of field elevations have been achieved to a very close approximation.

The contours can be considered as final resulting from this method, or they can be redrawn with slight adjustments to agree with furnished elevation control, and thereby be given a sea level datum and the designation of a particular key bed. Without this additional work, however, the contour result is just as graphic and complete for all practical purposes of oil exploration. In this case, the contours can be referred to an arbitrary datum and described as expressing surface structure throughout the area without any particular key bed.

The structural method described above, which requires the use of the floating line equipment, is the minimum requirement for successful mapping by photogeology in the Williston Basin. There are many who are not aware of this accomplishment of photogeology but it is hoped that they will soon appreciate its success as a separate tool requiring no field assistance, and which realizes its inherent speed, economy, and accuracy. The Williston Basin is one of the most important regions in which photogeology is now able to play a major role in exploration. * * *

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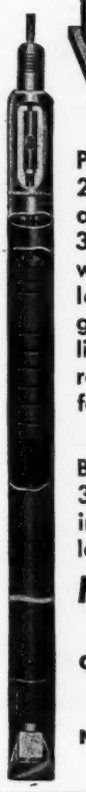

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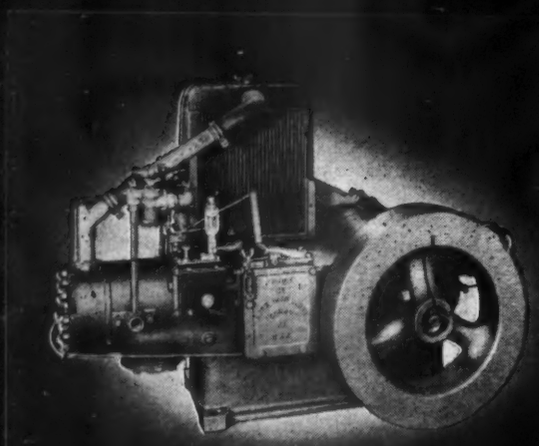

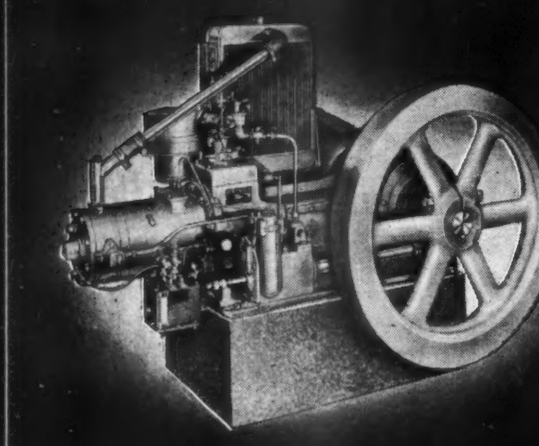

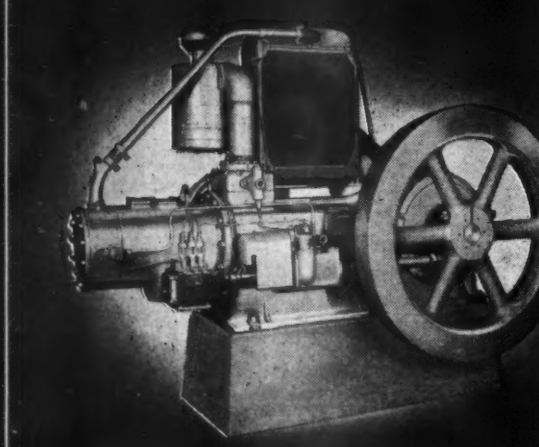

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Connate Water Resistivity in Oklahoma — Its Application to Electric Log Interpretation†

L. A. PUZIN

PURPOSE of the present paper is to provide a chart of connate water resistivity in Oklahoma, and to show the importance of this factor in the interpretation of electric logs. The symbols used in the following discussion are:

- Rt: True resistivity of the formation beyond the ring of mud invasion.
- Ri: Average resistivity of the invaded zone.
- Rm: Mud resistivity at the depth of the formation under study.
- Rw: Resistivity of connate water.
- Rz: Resistivity of contaminated water in invaded zone.
- Ro: Resistivity of the formation 100 per cent saturated with a water of resistivity Rw.
- F: Formation resistivity factor. We have by definition Ro = FRw.
- S: Water saturation in decimal fraction of porous space.
- P: Porosity in decimal fraction.
- m: Cementation exponent.
- n: Saturation exponent.

Conductivity of Rocks

It is well known that minerals entering into the composition of rocks are by themselves usually non-conductors of electrical current. This assumption is not in all cases absolutely correct, but the discussion of exceptions would be beyond the scope of the present paper.[1] For practical purposes it can be said that sedimentary rocks such as sands, shales, limestones, etc., have an electrolytic conductivity. This means that the electrical current, used to measure their resistivity, is conducted through a saline solution filling the interconnected porous spaces.

Resistivity and Fluid Saturation

The electric network made of conductive connate water and insulating minerals has a resistivity that is of course higher than the resistivity of the electrolyte.

If the porous formation is 100 per cent saturated with a brine of resistivity Rw, the total resistivity Ro is expressed by the relation $Ro = FRw^2$. F is called "Formation Resistivity Factor" and is constant for a given formation, provided the formation does not contain an appreciable amount of colloid. F is related to the porosity of the formation by the relation $F = P^{-m}$ or $P = \sqrt[m]{\frac{1}{F}}$ [2]

†Presented before Second Symposium of Subsurface Geological Techniques, University of Oklahoma, Norman.

L. A. Puzin is division manager for Schlumberger Well Surveying Corporation with headquarters in Oklahoma City. A native of Paris, France, he received his BS degree from the University of Paris. He joined Schlumberger in 1928 doing geophysical and well logging work in France, Africa, South America, Texas, and Oklahoma. He has been a resident of this country since 1935, and is one of the pioneers in electrical logging and one of the first to develop it in hard rock countries.

Cementation exponent m varies from 1.2 in loose sands to 2.2 in tight sandstones or limestones. Experiments have shown that in Oklahoma any value between 1.8 and 2.0 can be taken for exponent m. For simplification purposes one can use the form $F = \frac{1}{p^2}$. If the porous formation is not 100 per cent water saturated but contains also some non-conductive oil or gas, the resistivity is higher than Ro. It varies with the respective proportion of oil and water filling the porous spaces. The relationship between water saturation S and resistivity can be approximately expressed by the equation: $S^n = \frac{Ro}{Rt}$ [2].

Exponent n is commonly called "Archie Index" or "Saturation Exponent". This exponent does not seem to vary within broad limits, and, as a first approximation, can be taken about equal to 2 in most cases. Divergencies from these values have been observed but are not frequent. They are discussed in various papers and will be only mentioned here[3,4].

The above equation is also written:

$$S = \sqrt{\frac{Ro}{Rt}} \text{ or } S = \sqrt{\frac{FRw}{Rt}}$$

Basis of Quantitative Interpretation

The solution of the three fundamental equation: $Ro = FRw$, $S = \sqrt{\frac{FRw}{Rt}}$, $F = p^{-m}$ offers a method of calculating the water saturation and the porosity of previous formations provided the three factors involved, namely F, Rw, and Rt can be determined.

Rt is determined from the recorded or apparent resistivities corrected by means of "Resistivity Departure Curves" provided the bed under consideration is reasonably homogeneous and thick enough.[5,6,7]

F can be determined in the laboratory on formation samples. Some procedures are also being developed at present for a direct determination of F, particularly through a proper adjustment of the method of "Micrologging". It is furthermore possible to make use in favorable cases of the Tixier method where factor F has not to be previously known.[8,9]

Rw can be either calculated from the SP log[8,11] or taken directly out of a connate Water Resistivity Chart. Such a chart is hereby presented for Oklahoma formations (See Fig. 1).

Determining Rw from SP Curve

This method was indicated as early as 1934.[10] It was used by Tixier[8] and discussed by M. R. J. Wyllie.[11] It is based on the assumption that most of the SP departure from the shale base value is of electro-chemical nature and can be expressed by the equation $SPmv = K \log \frac{Rm}{Rw}$. The method has proven of considerable value. Its main disadvantage is that factor K may vary between -50 and -110, depending upon the composition of the brines and the colloidal content of the permeable formations. However, a local determination of factor K can be made accurately by using the connate Water Resistivity charts and solving the above equation for K.

Connate Water Resistivity Chart

Such charts are made by compiling resistivity values measured or calculated from connate water samples. Samples must be obtained from producing wells. Drill stem test samples must be as a rule discarded, inasmuch as they are contaminated by drilling mud. Likewise, samples from wells in the process of testing should be considered with suspicion. Only waters collected at the separator or bleeding valves of producing wells can be accepted as representative of connate water *in situ*.

Samples may be directly measured in a laboratory with a resistivimeter. This offers, of course, the best way of determination. A good value can be calculated from chemical analysis of samples,

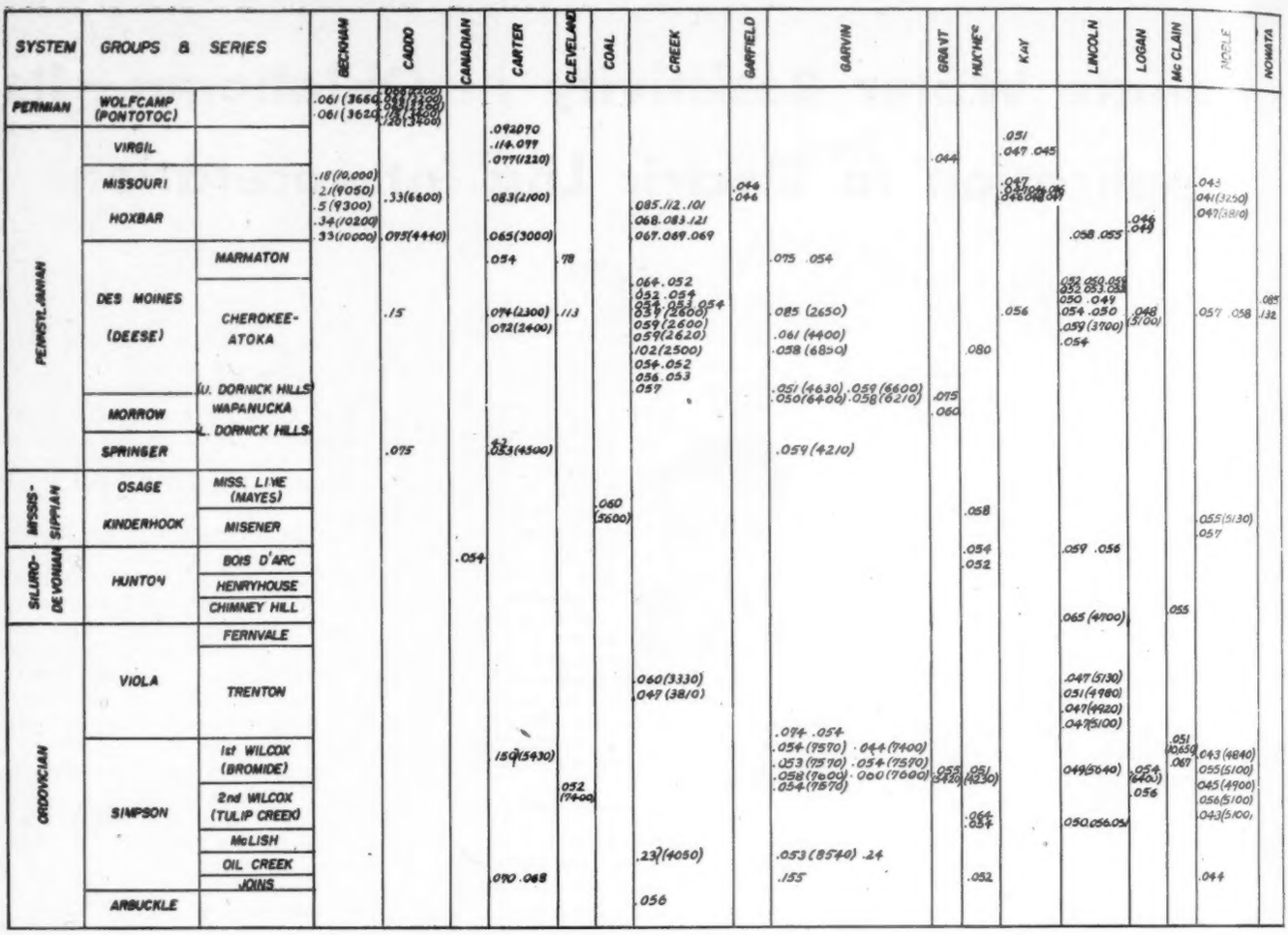


FIG. 1. Oklahoma connate water resistivity at 70 F—(Figures between

however. As chemical analyses are made for various petroleum engineering problems, a relatively abundant source of data can thus be tapped for the compilation of resistivity charts.

Calculation from Chemical Analysis

The conductivity of electrical current through an electrolyte is the result of the ionic dissociation of salt molecules in solution. The more ionic parts per million of salt the more conductive is the solution. Salts, however, differ in their ionic dissociation. Consequently, the same concentration of different salts will have different resistivities. Resistivity graphs are usually established for sodium chloride solutions. It is necessary, therefore, to express all salt solutions into their sodium chloride equivalent. Thus in terms of conductivity, 100 parts of $CaCl_2$ are equal to only 50 parts of NaCl. In figuring the concentration of a solution containing several salts, the amount of each salt must be multiplied by a correcting factor. The total of all amounts, thus corrected, gives the equivalent part per million of NaCl in solution. From this figure the resistivity is readily obtained by using the resistivity graph of salinity of NaCl solutions.

Oklahoma brines are for practical purposes, solutions of NaCl, $CaCl_2$ and $MgCl_2$. Other salts such as $CaSO_4$ are represented in negligible amounts. The fact that the three major components have a common element Cl, greatly simplifies the calculation of NaCl equivalents. In a standard water analysis report, the parts per million of each element are given. In order to group them by molecular compounds and reduce them into NaCl equivalents, the following method can be used in Oklahoma.

$$\text{Na ppm} \times 2.54 = \text{A}$$
$$\text{Ca ppm} \times 1.37 = \text{B}$$
$$\text{Mg ppm} \times 2.35 = \text{C}$$

Sum $\text{A} + \text{B} + \text{C} =$ equivalent ppm NaCl in solution.

The demonstration of this method is unimportant here but is given in the appendix.

It is furthermore known that the resistivity of an electrolyte decreases when the temperature increases. The resistivity of a solution at a given temperature can be determined, if the salt concentration is known, by means of appropriate graphs provided for this purpose.[6] To be comparable, all resistivities shown on the chart (Fig. 1) have been corrected to 70 F.

Equiresistivity Maps

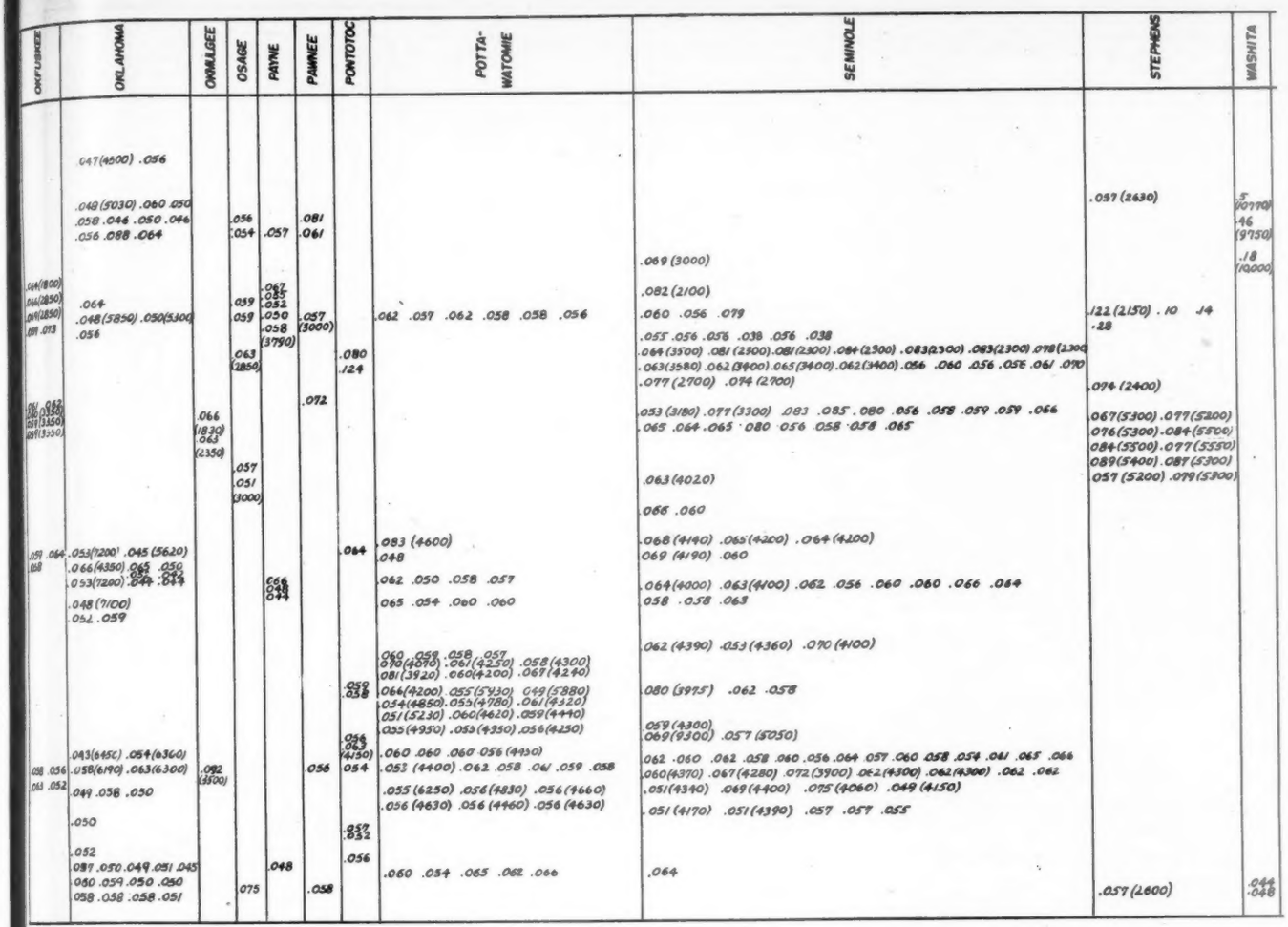
Resistivity values of a given geological horizon can be plotted on a map in order to show the geographical variations of the salinity of connate water within that particular horizon. Equiresistivity curves are thus obtained. We have established such maps for eight horizons, namely: Missouri-Hoxbar, Marmaton-Upper Deese, Cherokee-Atoka, Morrow-Springer, Mississippian, Siluro-Devonian, Viola and Simpson (Figs. 2-9). Some show very little lateral variations. Others, such as the Missouri-Hoxbar map, show a considerable increase in resistivity in the western part of the state. As a whole, most of the resistivities vary between .05 and .08 ohmmeter at 70 F. We have averaged the values in each township for each horizon. Those resistivities correspond to NaCl concentrations from 100,000 to 200,000 ppm, which is close to saturation.

The considerable decrease of concentration in the granite wash of western Oklahoma is submitted for an explanation in terms of sedimentology.

Application of the Chart to Quantitative Analysis

In order to concretize our exposé we shall consider a log from a well in Velma field, Stephens County, Oklahoma. The formation to be analyzed is a lower Dornick Hills (or Springer) sand at 4200 ft. The corresponding electric logs are shown in Fig. 10.

A core analysis of this formation was available and supplied the following:



parenthesis indicate approximate depth where water samples originate).

Average porosity ..... 19 per cent
Average formation factor 23.5
Connate water by restored state method ..... 12 per cent

How it is possible to derive the average value of water saturation and porosity from the data of the electrical log will now be examined, and the results obtained will be compared to the data of core analysis.

1. Direct Application of the Archie Formula: The resistivity chart gives Rw = .08 at 70°. The resistivity graph for salinity and temperature gives Rw = .054 at 106°. In this case, the average value of F is taken from core analysis, namely 23.5.

Furthermore, the true resistivity of the bed Rt after correcting the lateral value on the log is found equal to 102 ohm-m. Hence, the application of the Archie formula gives:

$$S = \sqrt[n]{\frac{F \times Rw}{Rt}} = \sqrt[2]{\frac{23.5 \times .054}{102}} = .11 \text{ or } 11\%$$

$$P = \sqrt[m]{\frac{1}{F}} = \sqrt[2]{\frac{1}{23.5}} = .21 \text{ or } 21\%$$

It can be readily seen that such a method is easy and of quick application. However, the use of it presumes that formation factor F be known.

2. Application of the Tixier Method: In the Tixier method, saturation and porosity are investigated without F being previously known. To this effect, the ratio of resistivities in the invaded zone and in the uncontaminated formation is considered.[8]

The resistivity of the invaded zone Ri is derived from the log after correcting for the short normal value. It should be emphasized that such a determination is only possible if the depth of the invaded zone is great enough that the short normal reading is substantially not affected by the presence of the uncontaminated part of the formation.

The equation obtained by Tixier is:

$$S = \frac{\frac{Ri}{Rt}}{\frac{Rz}{Rw}}$$

Rz is the resistivity of the fluid saturating the mud invaded zone. It is a mixture of connate water and drilling mud. If we call Siw the volume of connate water and Si the total volume of water in this mixture, we call $z = \frac{Siw}{Si}$. Ratio z usually varies between 5 and 10 per cent. It is considered as 7.5 per cent in Oklahoma. Tixier shows that:

$$\frac{Rz}{Rw} = \frac{\frac{Rm}{Rw}}{(1-Z) + z\frac{Rm}{Rw}}$$

As the ratio $\frac{Rz}{Rw}$ is a function of only z, Rm and Rw, it is possible to express S as a function of $\frac{Ri}{Rt}$ and $\frac{Rm}{Rw}$ for any value of z.

The chart presented herewith as Fig. 11 gives directly the saturation from the Tixier formula.

In the considered case we have:

$$\frac{Ri}{Rt} = \frac{85}{102} = 0.83$$

$$\frac{Rm}{Rw} = \frac{0.85}{0.054} = 16$$

$$S = .13 \text{ or } 13\%$$

After the saturation is determined, it is possible to derive the formation factor, and consequently the porosity through the formula:

$$Rt = \frac{FRw}{S^2} \text{ thus } F = \frac{102 \times .13^2}{.054} = 32$$

$$P = \sqrt[m]{\frac{1}{F}} = \sqrt[2]{\frac{1}{32}} = .18 \text{ or } 18\%$$

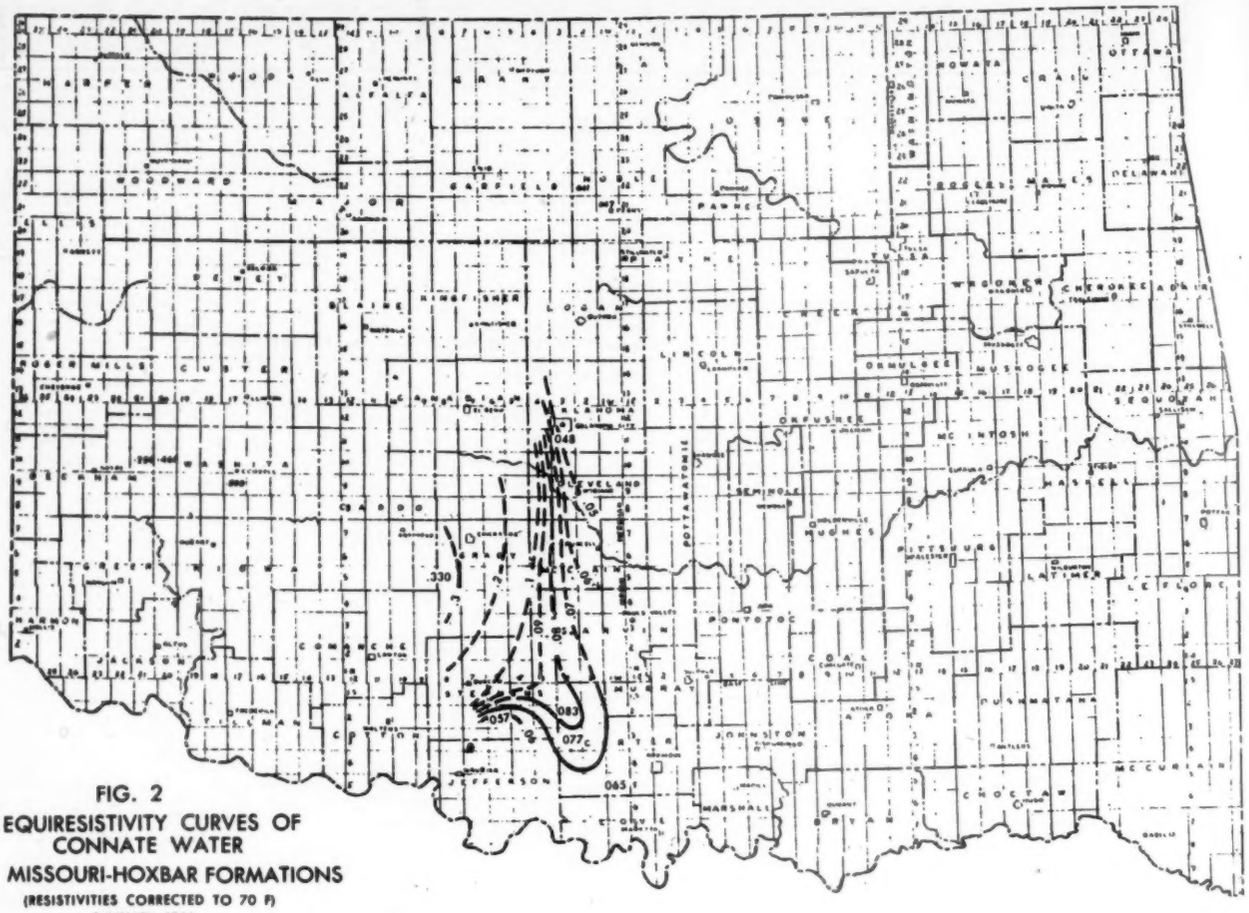


FIG. 2
EQUIRESISTIVITY CURVES OF
CONNATE WATER
MISSOURI-HOXBAR FORMATIONS
(RESISTIVITIES CORRECTED TO 70 F)
JANUARY 1951

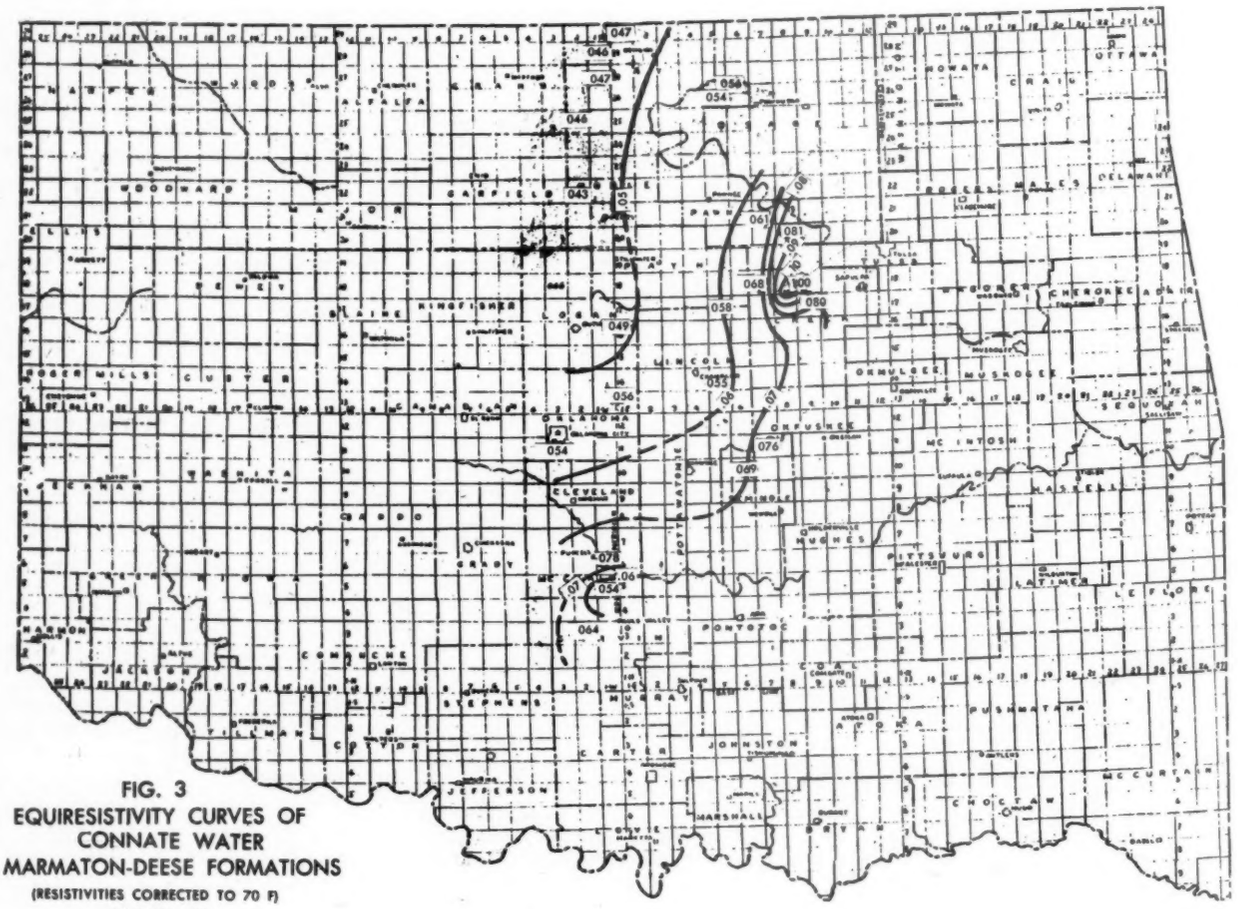


FIG. 3
EQUIRESISTIVITY CURVES OF
CONNATE WATER
MARMATON-DEESE FORMATIONS
(RESISTIVITIES CORRECTED TO 70 F)
JANUARY 1951

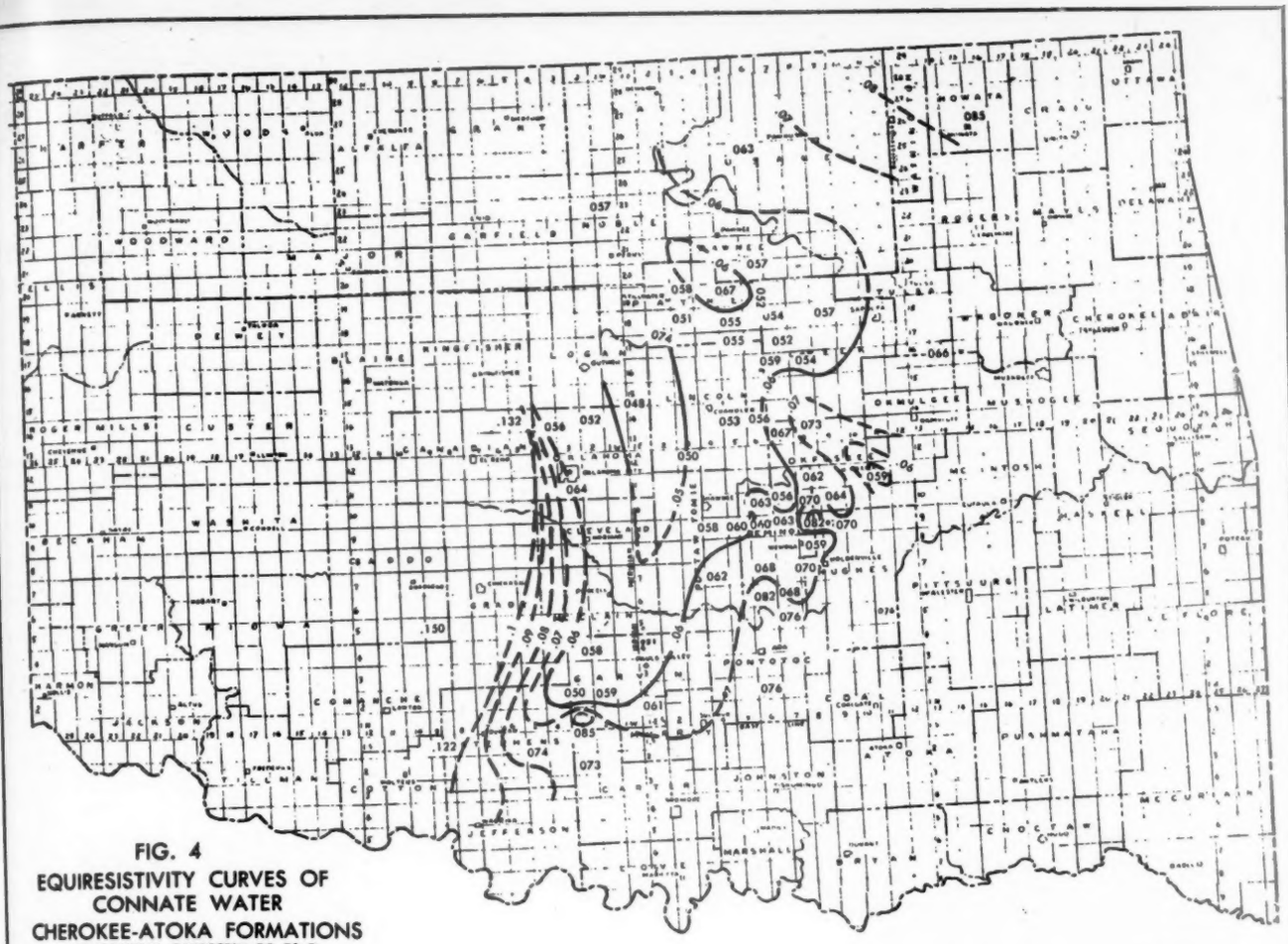


FIG. 4
EQUIRESISTIVITY CURVES OF
CONNATE WATER
CHEROKEE-ATOKA FORMATIONS
(RESISTIVITIES CORRECTED TO 70 F)
JANUARY 1951

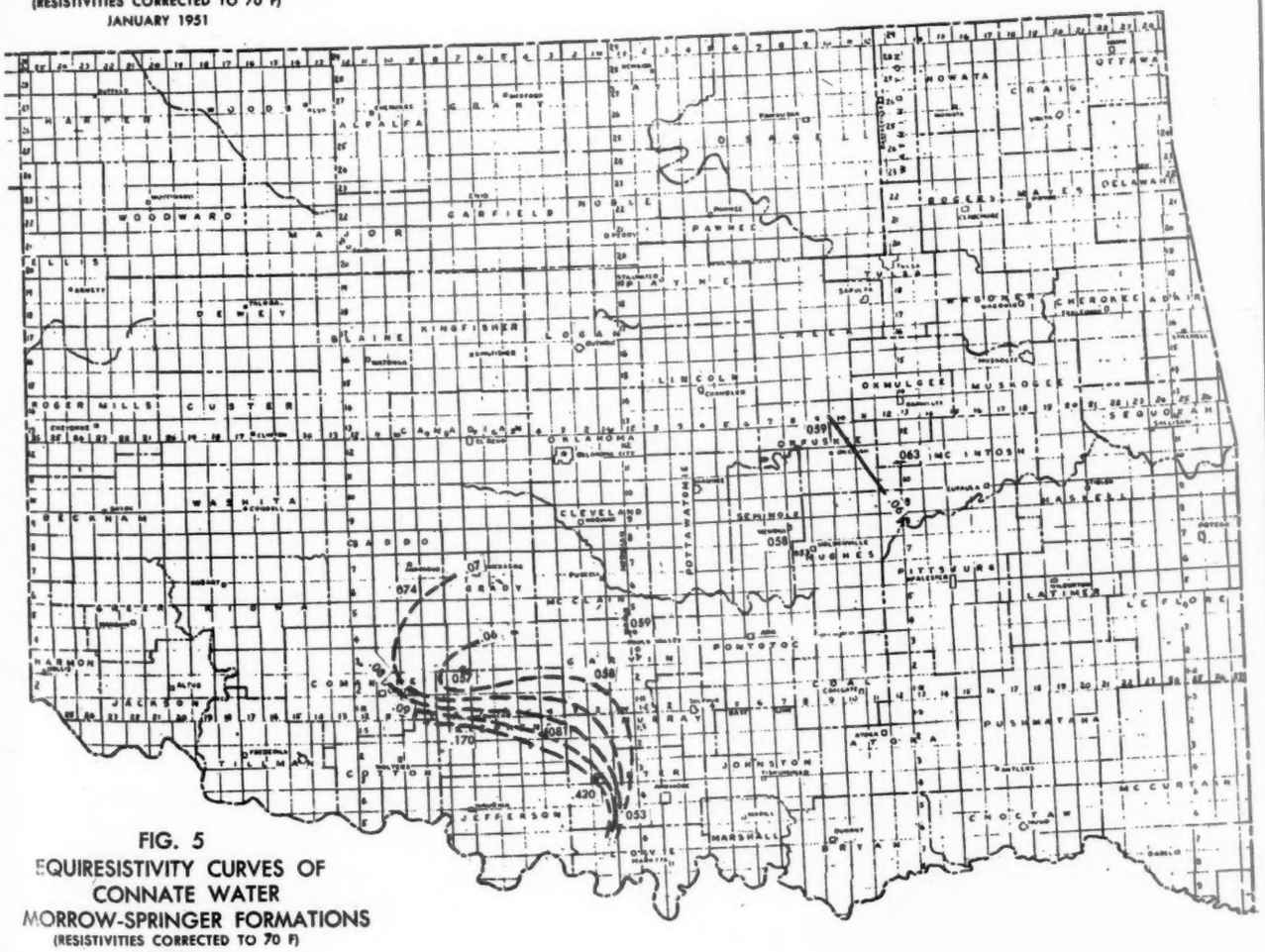


FIG. 5
EQUIRESISTIVITY CURVES OF
CONNATE WATER
MORROW-SPRINGER FORMATIONS
(RESISTIVITIES CORRECTED TO 70 F)
JANUARY 1951

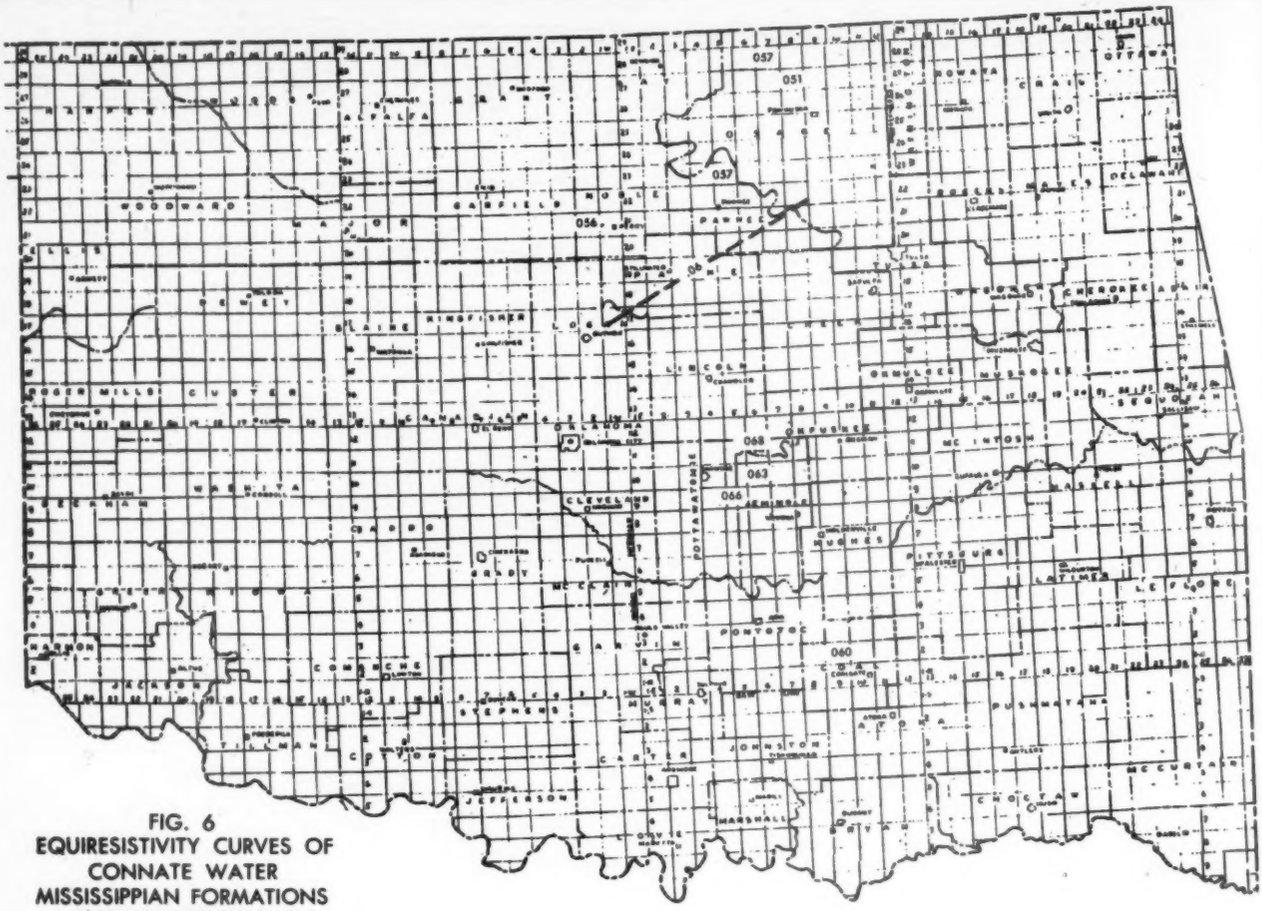


FIG. 6
EQUIRESISTIVITY CURVES OF
CONNATE WATER
MISSISSIPPIAN FORMATIONS
(RESISTIVITIES CORRECTED TO 70 F)
JANUARY 1951

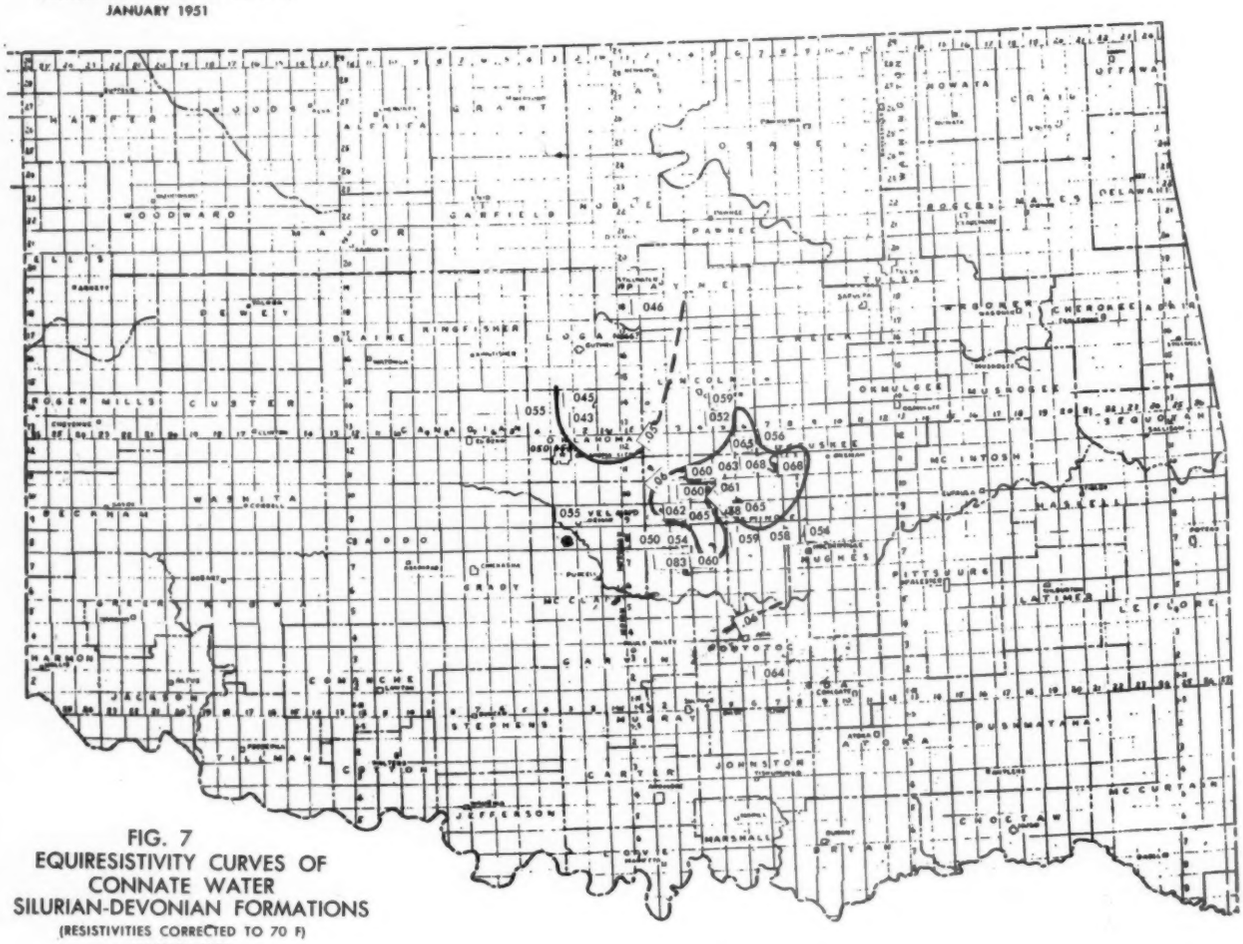


FIG. 7
EQUIRESISTIVITY CURVES OF
CONNATE WATER
SILURIAN-DEVONIAN FORMATIONS
(RESISTIVITIES CORRECTED TO 70 F)
JANUARY 1951

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- The Kellys are then carefully bored by precision drilling machines so that the bore is precisely centered end-to-end, then double-checked by highly-accurate survey devices. For products with bores 2¼" diameter or larger, wall thickness of the Kelly *must not* vary more than one-*sixteenth* inch for each 10 ft. of product length, or fraction thereof.
- The Kelly itself is also accurately surveyed for straightness and *must* be straight within one-*eighth* inch when measured at any point over its entire length.
- The alignment of the projected axis of each threaded end, when checked with the precise Baash-Ross Alignoscope, *must* be within one-*eighth* inch of the longitudinal axis of the Kelly for each 10 ft. of Kelly length, or fraction thereof.
- In addition, threads *must* pass, not only all API specifications, but also unusually rigid Baash-Ross specifications on thread form, taper, lead, finish, etc.

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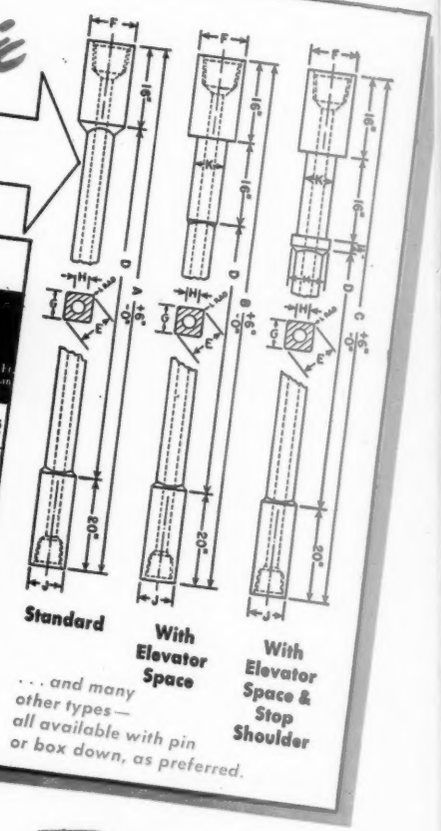
Baash-Ross "Trubore" Forged Upset Square Kellys

Nominal Size In.	LENGTHS Overall A Ft.	Overall B Ft.	Overall C Ft.	Working Length D Ft.	Top Upset Joint Size A.P.I. Left Hand In.	Top Upset O.D. E In.	Bottom Upset Joint Size A.P.I. Right Hand In.	Bottom Upset O.D. F In.	Bore I.D. H In.	Across Corner G In.	Across Flat K In.	Elevator Space O.D. L In.	Corner Radius M In.	Stop Shoulder O.D. N In.	†Cu. Ft. per Lin. Ft.
2⅞	35 38 40	36–4 39–4 41–4	36–6 39–6 41–6	32 35 37	4½ Reg. 6⅝ Reg.	5¼* 7¼	2¾ Reg. 2⅝ I.F.	3¼ 5⅛	1¼	2⅝	2⅜	2⅜	5/16	3⅝	.165 .327
3	35 38 40	36–4 39–4 41–4	36–6 39–6 41–6	32 35 37	4½ Reg. 6⅝ Reg.	5¼* 7¼	2⅞ Reg. 2⅞ I.F.	3¾ 4⅞	1¾ 1⅝	2	2	2⅜	⅝	4⅛	.165 .327
3½	35 38 40	36–4 39–4 41–4	36–6 39–6 41–6	32 35 37	4½ Reg. 6⅝ Reg.	5¼* 7¼	3½ Reg. 3½ F.H. 3½ I.F.	4¼ 4⅝ 4⅞	1½ 2 2⅛	2⅜	2⅜	2⅝	⅝	4⅛	.165 .327
4½	35 38 40 50 54	36–4 39–4 41–4 55–4	36–6 39–6 41–6 55–6	32 35 37 51	4½ Reg. 6⅝ Reg.	5¼* 7¼	4½ Reg. 4½ F.H. 4½ I.F.	5½* 6⅛	2¼ 2⅝ 2⅞	3⅛	3⅛	3⅜	½	4⅝	.165 .327
5½	38 40 50 54	39–4 41–4 55–4	39–6 41–6 55–6	35 37 51	6⅝ Reg.	7¾	5½ Reg. 5½ F.H. 5½ I.F.	6¾* 7⅜	2¾ 3⅛ 3¼	4⅛	4⅛	4⅜	½	5¾	.165 .327
6	38 40 50 54	39–4 41–4 55–4	39–6 41–6 55–6	35 37 51	6⅝ Reg.	7¾	6⅝ Reg. 6⅝ F.H.	7¾* 8⅛	3¼ 3½ 3⅝	5⅛	5⅛	5⅝	⅝	7	.327
7	38 40 50 54	39–4 41–4 55–4	39–6 41–6 55–6	35 37 51	6⅝ Reg.	7¾	7⅝ Reg. 7⅝ F.H.	8¾* 9⅛	3½ 3⅝ 3¾	6⅛	6⅛	6⅝	⅝	8	.327

Sizes shown in RED are A.P.I. standard.
* Alternate 5¾ inches O.D.—.180 cu. ft. per lineal ft
† Volume based on largest diameter of kelly



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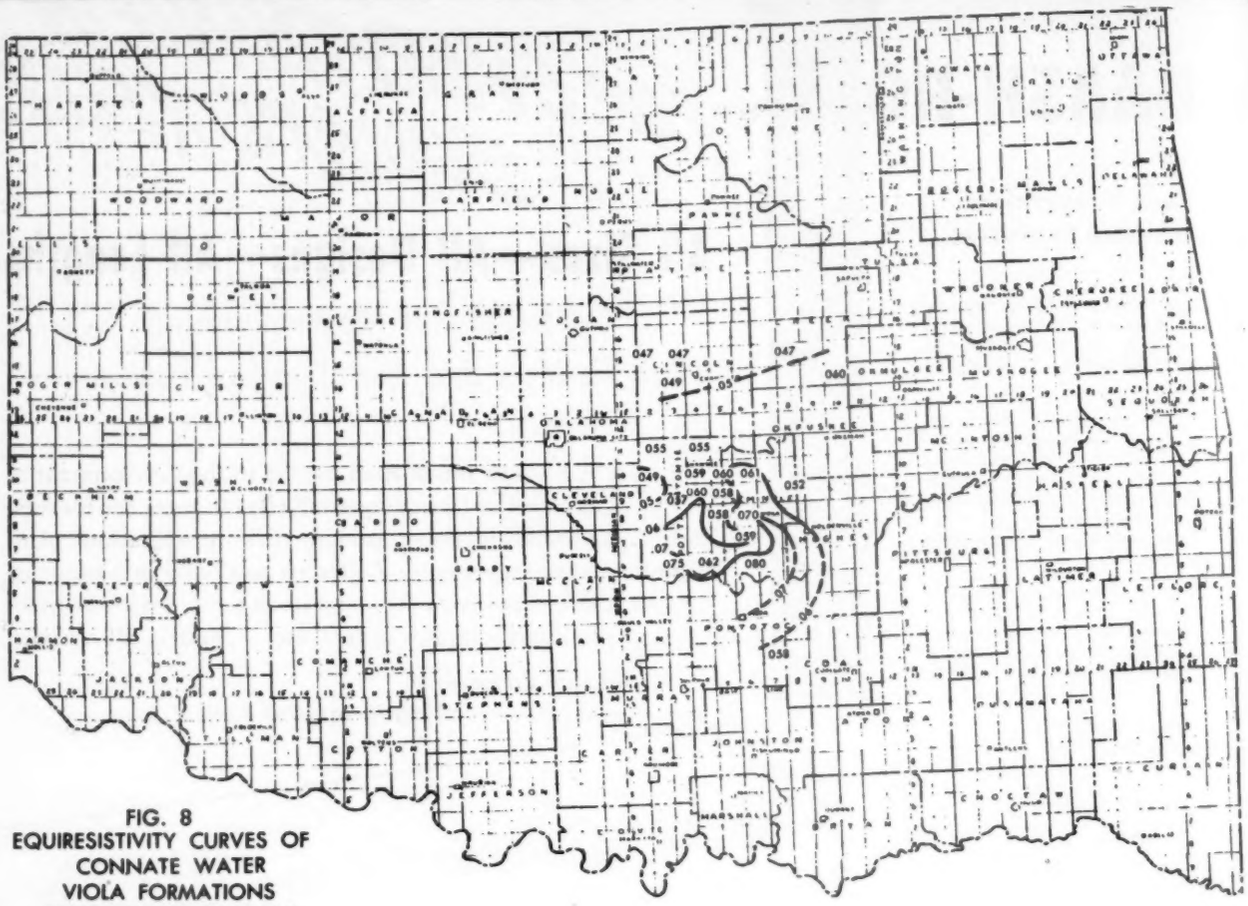


FIG. 8
EQUIRESISTIVITY CURVES OF
CONNATE WATER
VIOLA FORMATIONS
(RESISTIVITIES CORRECTED TO 70 F)
JANUARY 1951

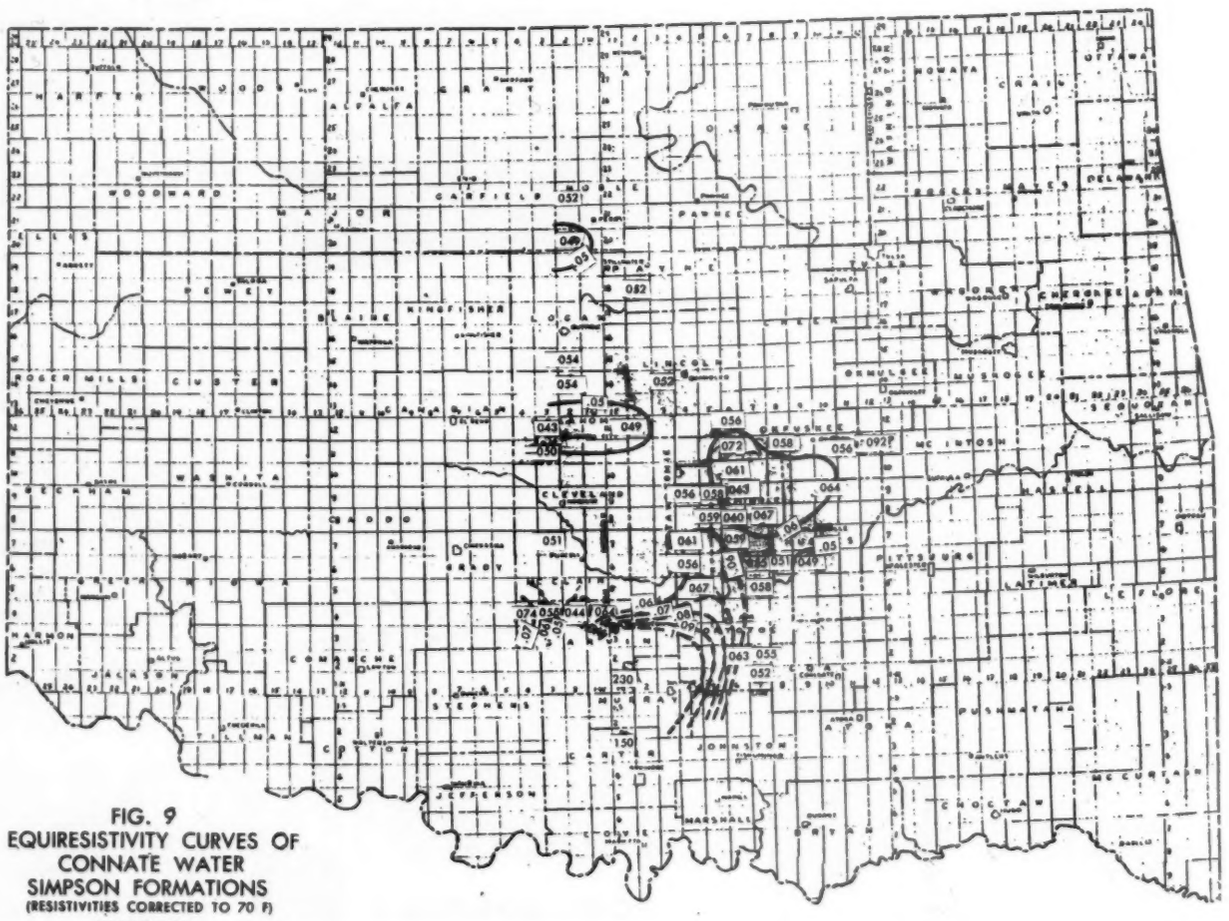
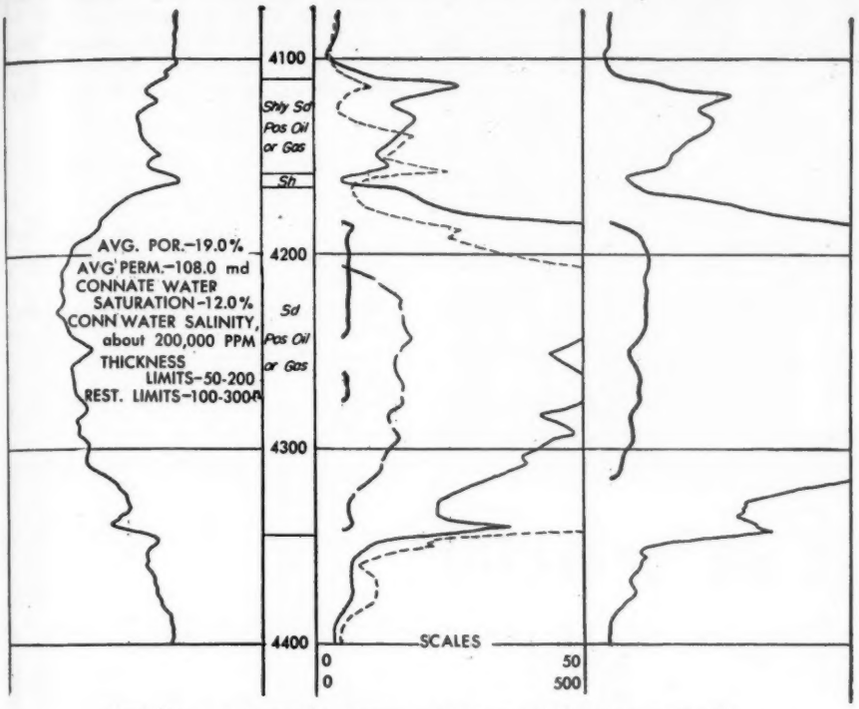


FIG. 9
EQUIRESISTIVITY CURVES OF
CONNATE WATER
SIMPSON FORMATIONS
(RESISTIVITIES CORRECTED TO 70 F)
JANUARY 1951

FIG. 10. Typical producing sand—Oklahoma-Duncan district.



Mud Res.—1.4 at 63°. Temp.—118° at 5400'. Hole size—9".
Spacings: AM-16"; AM'-64"; OA-24'.
Velma (IS-5W—Lower Dornick hills (or Springer)—Penn. age—"B" sand.

Conclusions

It is hoped that the presented charts will help in increasing the accuracy of electric log interpretation. The author acknowledges the cooperation of companies who supplied connate water samples and chemical analysis. Among these should be mentioned: Carter Oil Company, Dowell, Inc., Magnolia Petroleum Company, Shell Oil Company,

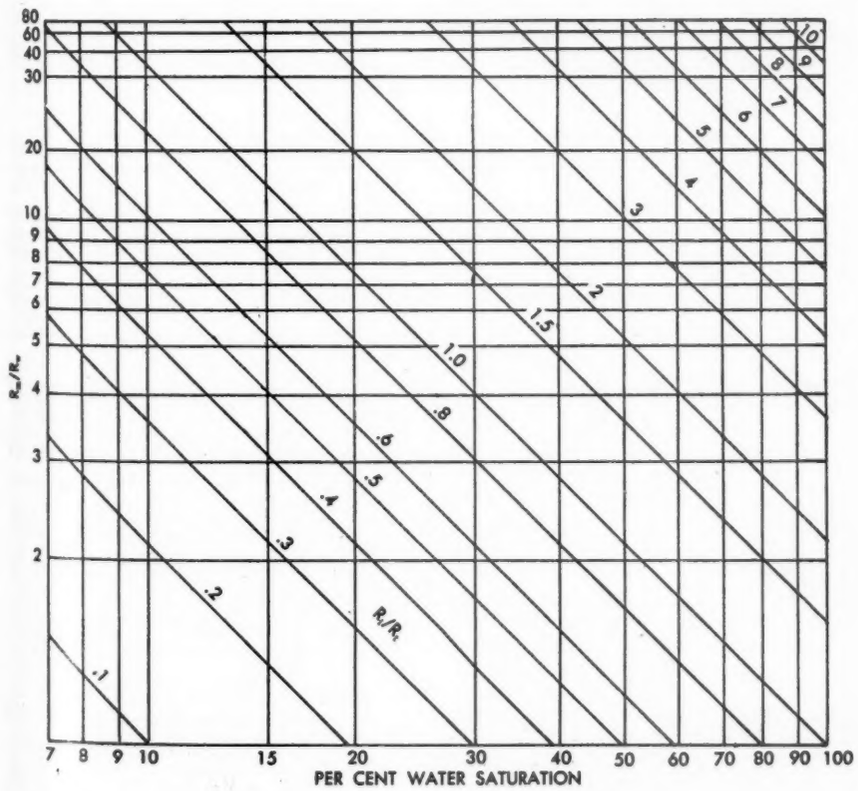
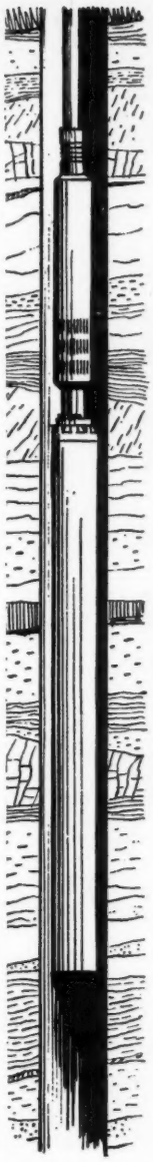


FIG. 11. Use only on zones known to be permeable—do not use if $R_t < 15$ OHMS—use only values corrected by departure curves.



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Reda pumps are given consideration as original or replacement equipment because of their known performance in producing fluid at a *lower* cost per barrel, thus often extending the ultimate economic life of wells.

Improved engineering and design have increased operating life. Increased operating life means *lower* labor cost per barrel, *lower* investment cost per barrel, *lower* maintenance cost per barrel: *lower cost per barrel produced.*

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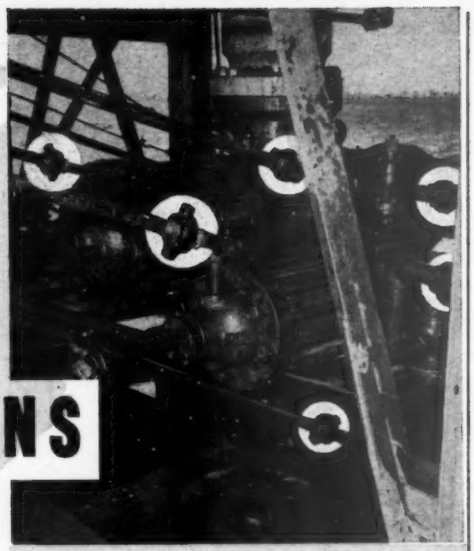

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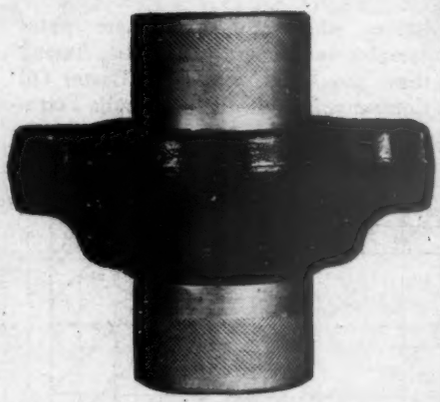
WE GO for WECO Fig. 600 UNIONS



This Union is ideal for pump manifolds – blowout preventer lines – mud lines – stand pipe connections – high pressure separator lines and other high pressure connections.

The replaceable bronze seat prolongs its use far beyond the normal service life of ordinary unions. It assures a seating surface unimpaired by rust on lines involving condensation.

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Inc., Sinclair Oil and Gas Company, Stanolind Oil and Gas Company, etc. M. Martin, C. A. Rosenthal, and W. D. Ford, engineers with Schlumberger Well Surveying Corporation, were of considerable help in carrying out this work.

Appendix

Calculation of Resistivity from Chemical Analysis (Oklahoma Brines)

The salts in solution are more than 99 per cent composed of NaCl, $CaCl_2$ and $MgCl_2$.

The atomic weight of each element is: Na=23 Cl=35.5 Ca=40 Mg=24

Consequently, we may write:

$$\text{Cl ppm in NaCl} = \frac{\text{Na ppm} \times 35.5}{23} = a$$

$$\text{Cl ppm in } CaCl_2 = \frac{\text{Ca ppm} \times 35.5 \times 2}{40} = b$$

$$\text{Cl ppm in } MgCl_2 = \frac{\text{Mg ppm} \times 35.5 \times 2}{24} = c$$

The parts per million of each compound will be, therefore:

$a + \text{Na ppm} = \text{NaCl ppm} = d$

$b + \text{Ca ppm} = CaCl_2 \text{ ppm} = e$

$c + \text{Mg ppm} = MgCl_2 \text{ ppm} = f$

The reduction factor of $CaCl_2$ and $MgCl_2$ into NaCl equivalents are respectively .5 and .6. We have therefore:

$d = \text{NaCl ppm equivalent} = A$

$e \times .5 = \text{NaCl ppm equivalent of } CaCl_2 = B$

$f \times .6 = \text{NaCl ppm equivalent of } MgCl_2 = C$

or after simplification:

$\text{Na ppm} \times 2.54 = A$

$\text{Ca ppm} \times 1.37 = B$

$\text{Mg ppm} \times 2.35 = C$

Sum $A + B + C$ = equivalent ppm NaCl in solution.

References

1. H. W. Patnode and M. R. J. Wyllie: "The Presence of Conductive Solids as a Factor in Electrical Log Interpretation", *Petroleum Technology*, February, 1950.
2. G. E. Archie: "The Electrical Resistivity Log as an Aid in Determining Some Reservoir Characteristics", *AIME*, Technical Publication No. 1422, October, 1941.
3. Dunlap, Bilhartz, Shuler and Bailey: "The Relation Between Electrical Resistivity and Brine Saturation in Reservoir Rocks", *AIME*, Petroleum Transactions, October, 1949.
4. Dr. Leendert de Witte: "Relations Between Resistivities and Fluid Content", *The Oil and Gas Journal*, August 24, 1950, Page 126.
5. H. G. Doll, J. C. Legrand and E. F. Stratton: "True Resistivity Determination from the Electric Log", *The Oil and Gas Journal*, September 20, 1947.
6. Schlumberger Well Surveying Corporation: "Document No. 3", 1950.
7. H. G. Doll: "Introduction to Induction Logging", *Petroleum Technology*, September, 1948.
8. M. P. Tixier: "Electric Log Analysis in the Rocky Mountains", *The Oil and Gas Journal*, June 23, 1949.
9. H. G. Doll: "The 'Microlog'—A New Electrical Logging Method for Detailed Determination of Permeable Beds", *AIME*, February, 1950.
10. Conrad & Marcel Schlumberger: "A New Contribution to Subsurface Studies by Means of Electrical Measurements in Drill Holes", *AIME*, Volume 110, 1934.
11. M. R. J. Wyllie: "A Quantitative Analysis of the Electrochemical Component of the SP Curve", *AIME*, Petroleum Transactions, January, 1949.
    M. R. J. Wyllie: "A Statistical Study of the Accuracy of Some Connate Water Resistivity Determination Made from SP Log Data", AAPG Meeting, March, 1949. * *

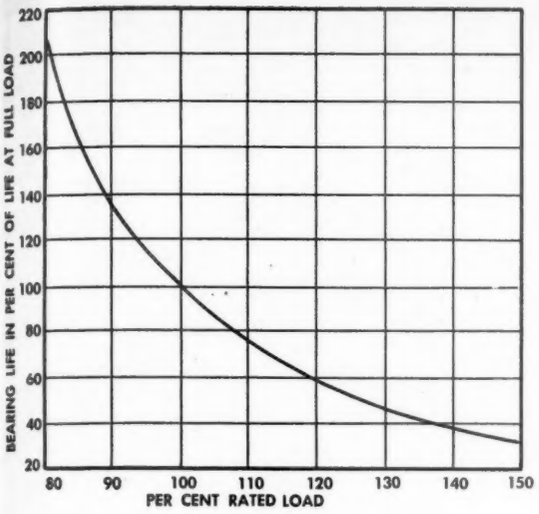


FIG. 1.

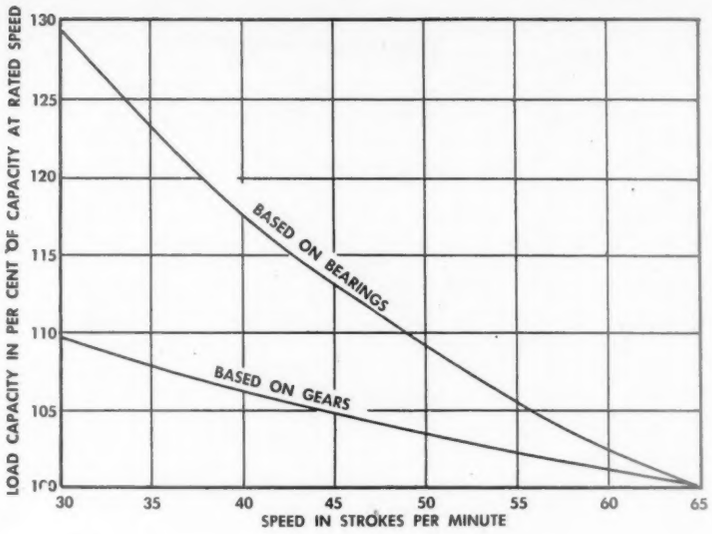


FIG. 2.

How to Operate and Maintain Slush Pumps

Initial selection of pump and operating it at most efficient load and speed will lower costs

KENNETH N. MILLS

THE cost of operating any piece of equipment is a function of the magnitude and nature of the applied load, the total daily operating time, and the care used in its maintenance. Operating costs usually increase as the load is increased, and they usually increase at an accelerated rate when the capacity of the machine is approached and exceeded. They also increase as the ratio of the operating time to idle time approaches unity, because this reduces the time available for preventive maintenance. When these rules are applied to the slush pump on a rotary drilling rig, it is apparent that it is a potentially expensive piece of equipment to operate, and therefore, is a fruitful location for savings through proper operation and maintenance. As maintenance of mud circulation is essential to the rotary drilling process and the protection of the hole, it is highly desirable to keep the pump in good operating condition to assure dependability when it is called on to perform emergency duty.

Basically, mud pump dependability must be assured in the initial selection of the pump. The pump must be selected with sufficient capacity to perform the desired task. The magnitude of this task is dependent on the depth and size of the hole, the size of drill pipe, the type of drill bit used, and the nature of the formation to be drilled. This phase of the problem has been covered by a number of excellent articles[1,2,3,4], and therefore will not be reviewed. The selection of an oversized pump will not penalize the operation of the pump, but it will increase the moving expense and the capital rate on the drilling rig. If the pump is selected too small for the job, its maintenance costs will be excessively high, and its dependability will be poor, resulting in a failure at a critical moment.

Basically, all mud pumps are designed and rated on the basis of either input or output horsepower. This basis of rating is of little practical value in the field, because most mud pumps are driven from drilling rigs with power capacities in excess of the power capacity of the pump. For this reason all mud pumps carry name plates showing the maximum pressures for various size of liners when the pump is operating at its maximum speed. This rating gives the drilling crew a practical means for determining the load on the pump, and the pump loading can be controlled by changing liner sizes. If this practice is not followed, and the pressure capacity of the pump is exceeded, the life of the pump will be reduced, and the cost of operating the pump will increase. The amount of this life reduction cannot be accurately estimated, because each mechanical element in the pump has different failure characteristics. If the pump lubrication is assumed to be perfect, it is possible to predict the variation in roller bearing life expectancy with respect to the load. If the lubricant is clean and non-corrosive, the bearing life will vary with the cube of the load, or expressed in terms of pump ratings, with the cube of the piston rod load. The variation in bearing life with load assuming constant speed is shown graphically in Fig. 1. In this illustration it will be noted that a small increase in load will produce a large reduction in bearing life. As this graphical illustration is based on a constant speed, it does not present the complete relationship between bearing load and life. If the bearing life expectancy is kept constant, the load capacity of a roller bearing varies with speed, and it increases as the speed is decreased. This effect is illustrated in Fig. 2. This would indicate that, considering the roller bearings, only the load capacity of the pump increases as the pump speed is decreased. This may or may not apply to the other load carrying elements in the pump power train, and they must be considered before this capacity can be utilized.

EXCLUSIVE

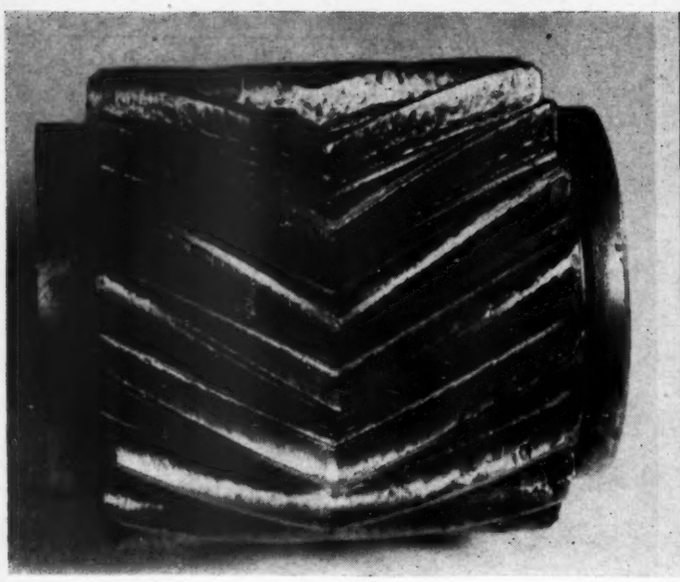


FIG. 3.

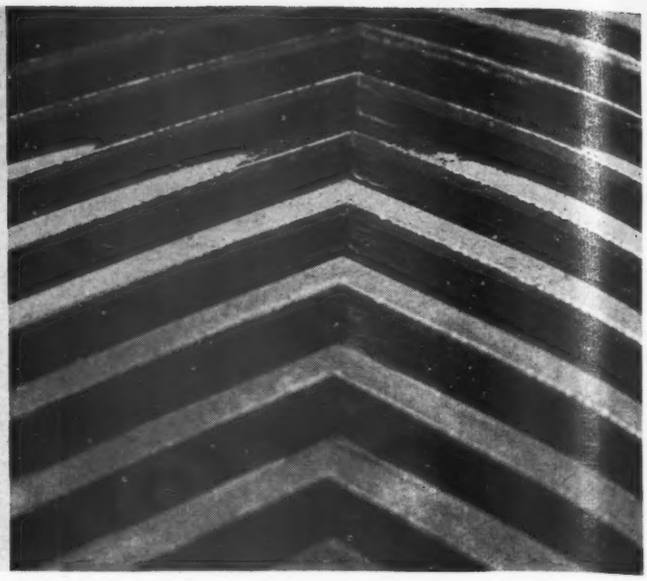


FIG. 4.

The factors determining the relationship between gear life and load are well known. Due to the complex nature of gear tooth action and the large number of variables involved, however, it is impossible to predict accurately their load-life characteristics. The conventional gear rating formulas indicate that the load capacity of the gears increase as the speed is decreased. This relationship is shown graphically in Fig. 2. In this illustration it will be noted that the rate of increase in gear load capacity with decreasing speed is less than that for the roller bearings, and therefore the gears may be the load limiting factor. As previously stated, the performance of the gears is influenced by several variables, as they are subject to two distinct types of failure. They can fail by tooth breakage or surface deterioration. Failures resulting in tooth breakage are usually the result of prolonged overload or excessive loads resulting from fluid pounds or engine vibrations. Failures of this type are less common than those resulting in surface deterioration. Tooth surface deterioration failures can be caused by improper lubrication or overload. The common types of failures caused by improper lubrication are galling and abrasive wear. A typical galling type failure is shown in Fig. 3. This type of failure occurs when the oil film is ruptured and metal to metal contact occurs between metering teeth. In cases of this type the film strength of the lubricant is the load capacity limiting factor.

If the lubricant has sufficient film strength to carry the tooth loads, the fatigue strength of the gear material is the load limiting factor. If the surface fatigue strength of the gear teeth is exceeded the tooth surface will fail by destructive pitting. The tooth damage resulting from this type of failure is progressive. In its early stages small pits will appear on the tooth faces. The significance of these pits can not be determined in their formative stages, because they will appear in well cut, normally loaded gears. If the gears are not overloaded, they will eventually disappear. If the gears are overloaded the size and number of pits will increase until the entire tooth surface is destroyed. A typical failure of this type is shown in Fig. 4. The mechanics of this process of failure is rather involved, and the film strength of the lubricant is one of the factors controlling the process. The resistance of the gears to failures of this type increases as the film strength of the lubricant is increased. For this reason the load-life characteristics of the gears can not be accurately predicted.

The other pressure limiting factors in the mud pump are the fatigue and column strengths of the frame, crank shaft, connecting rod, mud rod, and oil rod. As each of the elements are subject to dynamic loads, they are subject to fatigue, and their life is a function of load intensity. Due to design variations, the life-load characteristics of these parts can not be covered by a general formula. Therefore, the manufacturer should be consulted before the pressure capacity of the pump is exceeded at low speeds.

As the life of the power and fluid end parts is a function of load intensity the operating and maintenance practice should be selected to eliminate all unnecessary loads resulting from fluid knocks and torsional vibrations in the driving system. Fluid knocks are caused by underfilling of the cylinder on the suction stroke, and they subject the pump to high intensity loads that reduce the life of the moving parts. The possibility of smooth operation can be assured in the design of the suction piping and location of the pumps. The pump should be close to the slush pit, and be kept as low as possible to reduce the suction in lift. The suction pipe or hose should be at least the full size of the suction opening on the pump, and should have a uniform slope upward to the pump to eliminate air pockets. If it is necessary to make turns in the suction line, extra long sweep fittings should be used, and all valves placed in the suction line should be of the full opening, straight flow-through type. If the suction line is unusually long, its size should be increased to decrease the pressure loss in the suction line.

The suction line should be fitted with a strainer to prevent sticks and trash from entering the pump. It is preferable to place the strainer in the slush pit to keep the pressure losses through the strainer at a minimum. The total area of the openings in the suction strainer should be several times the area of the suction line. This will assure a low velocity through the strainer, thus reducing the pressure loss through the strainer and the attraction of the strainer for trash.

Some of the more common causes for

The Author

Kenneth N. Mills received a BS degree in mechanical engineering from Rice Institute in 1933. After he graduated he joined American Manufacturing Company of Texas and became chief engineer of that company. In 1940 he joined Bethlehem Supply Company as chief engineer. During the war he became works manager for Texasteel Manufacturing Company and later assistant chief mechanical engineer of Emsco Derrick and Equipment Company at Houston. He joined Ideco as machinery products manager at Columbus in 1949. He has been responsible for the development of numerous theoretical approaches to oil well pumping problems.

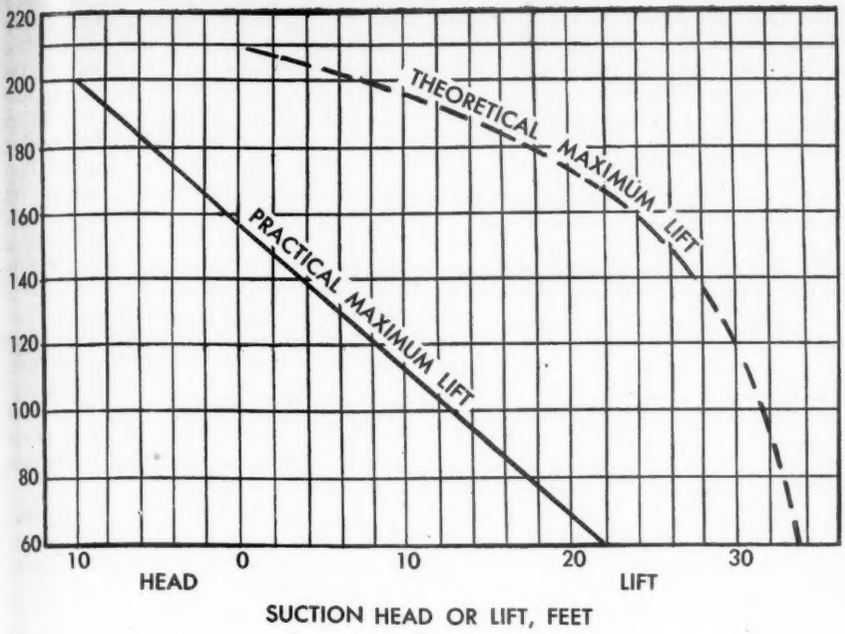


FIG. 5.

fluid knocks are listed below. All these causes for fluid knocks can be eliminated by proper maintenance.

1. Fluid cut valves.
2. Insufficient valve lift due to obstruction in upper valve guide.
3. Valve not seating due to worn valve or defective guide.
4. Excessive spring load on suction valve.
5. Air leak in suction line.
6. Very loose pressure sealing piston rod packing.
7. Accumulation of sand in suction line partially blocking suction line.
8. Piston loose on piston rod.
9. Excessive speed or very hot mud.

The relationship between pump speed and fluid knocks is rather complex, as it is influenced by the pressure losses in the entire suction system. The pressure losses in the suction system are dependent on fluid velocity in the suction system, mud weight, and viscosity, and they increase as each of these factors is increased. All pumps can be operated at their rated speed when the suction line is short and the mud weight, viscosity, and temperature are normal. As the length of the suction line is increased, or the weight of the mud is increased, it may become necessary to reduce the pump speed to prevent severe fluid knocks as this will reduce the fluid velocity, and therefore, will reduce the pressure drop in the suction line. As the drilling mud is usually composed of water, the temperature of the mud will influence the maximum allowable pressure loss in the suction system. Increasing the temperature of the mud increases its vapor pressure and increases the tendency for steam to be formed in the suction system. The effect of temperature on the suction lift for clear water at sea level is shown in Fig. 5. In this chart it will be noted that the allowable suction lift decreases as the temperature increases, and ultimately reaches a maximum temperature beyond which the fluid can not be pumped. The use of steel mud tanks, and flooded suctions will decrease the tendency for the above adverse conditions to cause fluid knocks, because they increase the pressure in the suction system. Difficulties of this type can be completely eliminated by using a centrifugal pump to super charge the suction system.

The principal item of maintenance expense on a properly loaded slush pump is expendable fluid end parts. The service life of these parts can be influenced by the care used in pump maintenance and operating practices. The piston rod and its packing are typical examples of parts whose life is influenced by the care used in installation and adjustment. The piston rod packing gland tension should be just enough to prevent leakage. Excessive gland tension will create excessive friction and the heat developed by this friction will weaken or burn the packing, thus decreasing its life. This friction heat will also reduce the resistance of the piston rod to scoring and reduce its life. The sensitivity of the piston rod packing to gland tension can be reduced by using oil in place of water as a piston rod washing medium. The oil will reduce the frictional losses in the packing and materially increase the life of the piston rod and its packing. Piston rod scoring can be caused by uneven tightening of the nuts on a bolt type gland. If these nuts are not tightened down uniformly, one side of the gland may drag on the piston rod as shown in Fig. 6. This will

FIG. 6.

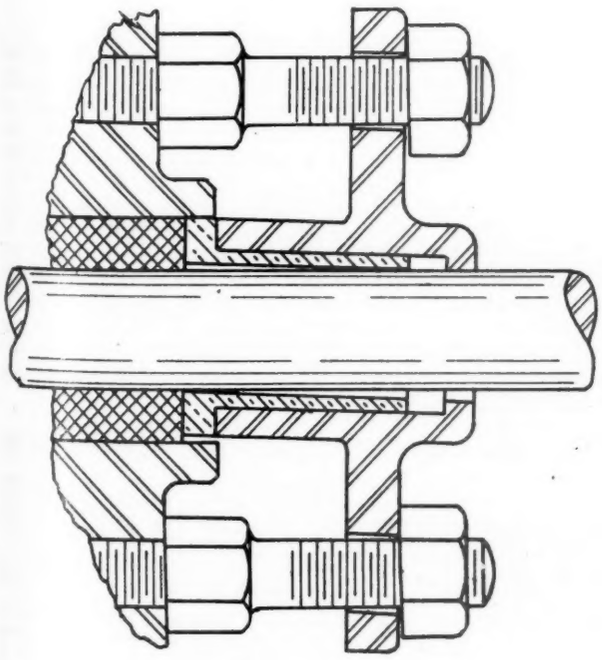
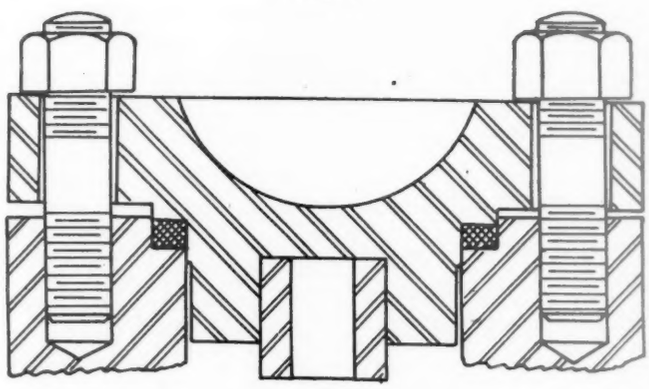


FIG. 7.



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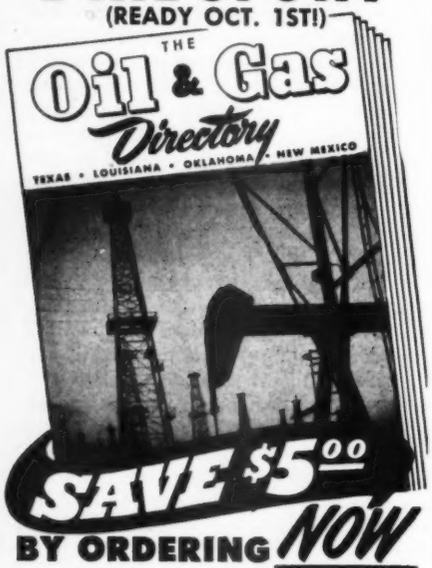

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cause excessive piston rod wear, also it will cause gland stud failures, because the load will not be uniformly distributed between the studs.

The life of the liners and pistons will be influenced by the care used in installing and maintaining these parts. Knocks resulting from loose pistons can be prevented by proper installation of the piston on the rod. The tapers in the piston head and on the rod must be cleaned before installing the piston head on the rod. The piston head should be driven up tight on the rod before the nut is tightened. This practice affords a check on the conditions of the tapers and will help prevent the piston becoming loose on the rod. Before an old piston is installed in a pump its sealing lips should be inspected for cuts. If a cut piston is used, the fluid will pass through the cut at a high velocity, and this high velocity fluid will cut the liner. Once a cut is started in the liner, its size will increase at a rapid rate, and both the piston and the liner will be destroyed. Liner scores can be caused by non-uniformly worn pistons as the non-uniform wear will permit the center steel ring on the piston to drag on the liner, and this will score the liner. Once a liner becomes scored or fluid cut, it is worthless, because it will eat piston rubbers at an excessive rate.

Proper tightening procedures will keep the frequency of valve pot cover and cylinder head stud failures at a minimum. The cover studs should be tightened down evenly and uniformly to assure that each stud carries its proportion of the load in the most advantageous manner. If one nut is tightened before the others are in snug contact with the cover, the cover may be cocked as shown in Fig. 7. This causes the load to be applied eccentrically to the stud, and will cause the stud to fail, because it materially increases the stress in the stud.

To assure good belt life the pump must be carefully aligned with the driving sheave on the drilling rig. The pump should be set level on a solid footing, and its sheave must be parallel and in line with the driving sheave. If the sheaves are not in proper alignment, the life of the belts will be reduced because the load will not be uniformly distributed between the various belts, and some of the belts will carry excessive loads. To assure the maintenance of proper belt tension and drive alignment the pump should be secured to the substructure with screw type pump spacer. The "V" belts should be sufficiently tight to carry the imposed load without slipping, but they should not be overtightened. The slight inequalities in the lengths of the various belts will equalize under load. If the belts are excessively tight, the belts will wear at an excessive rate and the excessive load may cause premature failures of the pump pinion and pump drive shaft bearings. Also, it can cause shaft failures on both the pump and drilling rig.

The true protective value of the pressure relief valve used to protect the pump from damage due to sudden overloads depends on its being properly set and maintained. If the relief valve is the shear type, the size of the shear nail must be changed each time the liners are changed. The relief valve setting should be approximately 50 per cent above the recommended pressure for the liners being used. If the operation is carried on in sub-freezing temperatures the valve should discharge directly into the atmosphere. If the valve discharge is piped into the pump suction or into the mud pit, water collecting in the line may freeze and prevent the proper functioning of the valve. The practice of piping from the discharge of the relief valve is dangerous when freezing is not probable, because the line may become clogged with dried mud.

Proper lubrication is one of the prime factors influencing power end maintenance and it includes more than filling the pump with the grade of oil recommended by the manufacturer. To assure proper lubrication it is necessary to change oil to remove the products of normal wear, moisture from condensation and leakage through the diaphram packing. The diaphram packing should be kept tight and in good condition at all times to prevent drilling mud from entering the power end. If drilling mud enters the power end it will cause the bearings to wear at an excessive rate, and necessitate unnecessary oil changes. If the pump operates in a humid area it may be necessary to change oil at very frequent intervals to remove water that accumulates from condensation in the power end.

In dry areas where condensation is not a problem, the oil should be changed once each year to remove the products of oil oxidation and normal wear. If these products are not removed, they may cause excessive gear and bearing wear. Each time the oil is changed, the power end should be flushed out with crank case flushing oil to remove the products of normal wear.

When the rig is stacked, the pump should be conditioned to resist corrosion. The fluid end should be thoroughly cleaned and all machined surfaces should be coated with heavy grease. The piston rod extension or oil rod should be coated with a heavy grease. The power end should be opened and cleaned. After the power end is thoroughly cleaned of sludge, all bright metal surfaces should be coated with a rust proofing material. This material should be soluble in the normal operating oil to eliminate the necessity for re-cleaning the power end when the pump is placed back in service.

References

1. "Application of Mud Pumps," by Kenneth N. Mills, World Oil, August 1949.
2. "An Analysis of Hydraulic Factors Affecting The Rate of Penetration of Drag Type Rotary Bits," by J. R. Eckel. J. P. Nolley presented at Spring Meeting, API Southwestern District Meeting 1949.
3. "The Flow Properties of Drilling Mud," by T. H. Dunn, W. F. Nuss, R. W. Beck, World Oil 1949.
4. "Selecting the Drillstem," by Stanley Moore and Bruno Scharbarum, The Oil and Gas Journal, October 13, 1949.

★ ★ ★

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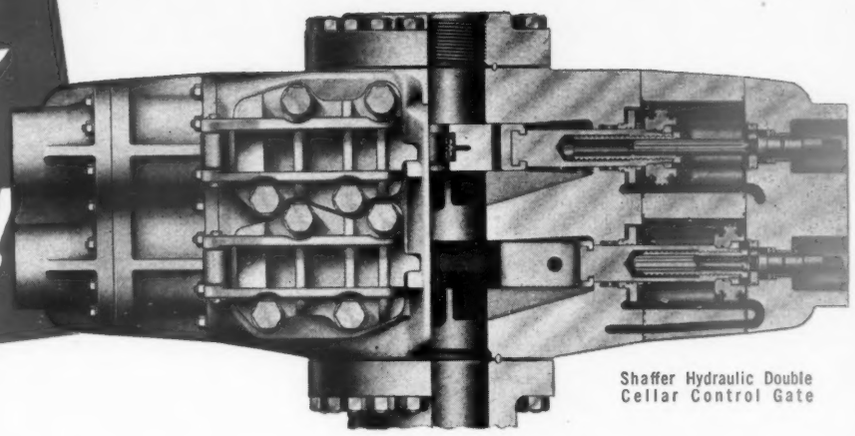

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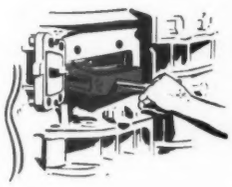
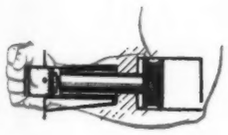


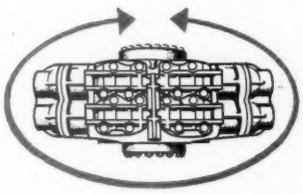
As wells are drilled, rams must be changed frequently to meet requirements of varying pipe sizes. In Shaffer Hydraulic Gates ram changes are unusually easy—simply open two doors in the side of the body, slide out the ram assembly, change rams, slide the assembly back in place and bolt the doors. **Moreover, complete ram changes can be made with equal ease whether the pipe is in or out of the hole!**

✓CHECK: POSITIVE DIRECT DRIVE!



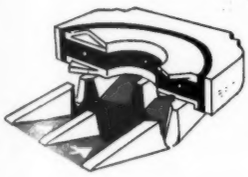
Shaffer Hydraulic Gates have no complicated hook-ups or secondary connections between rams and operating cylinders. Operating pistons are **directly behind** the rams for positive fool-proof drive, fewer parts, simple maintenance!

✓CHECK: FULLY-ENCLOSED DESIGN!



Note how Shaffer Hydraulic Cellar Control Gates have no exposed moving parts. All operating members are enclosed **within** the gate body—protected from corrosive muds, from abrasive grit and sand, from jamming by loose timbers or other objects dropped into the cellar. Even the locking shaft is non-rising—fully protected!

✓CHECK: MUD-FREE DRAINAGE!



In Shaffer Gates the rams move on high narrow guide ribs above the steeply-sloped ram compartment bottoms. Mud and sand quickly drain back into the well—no detrimental accumulations to interfere with free opening and closing of the rams!

Individually, every one of these features represents a vital operating advantage. Yet you find all these points of superiority in Shaffer Hydraulic Cellar Control Gates.

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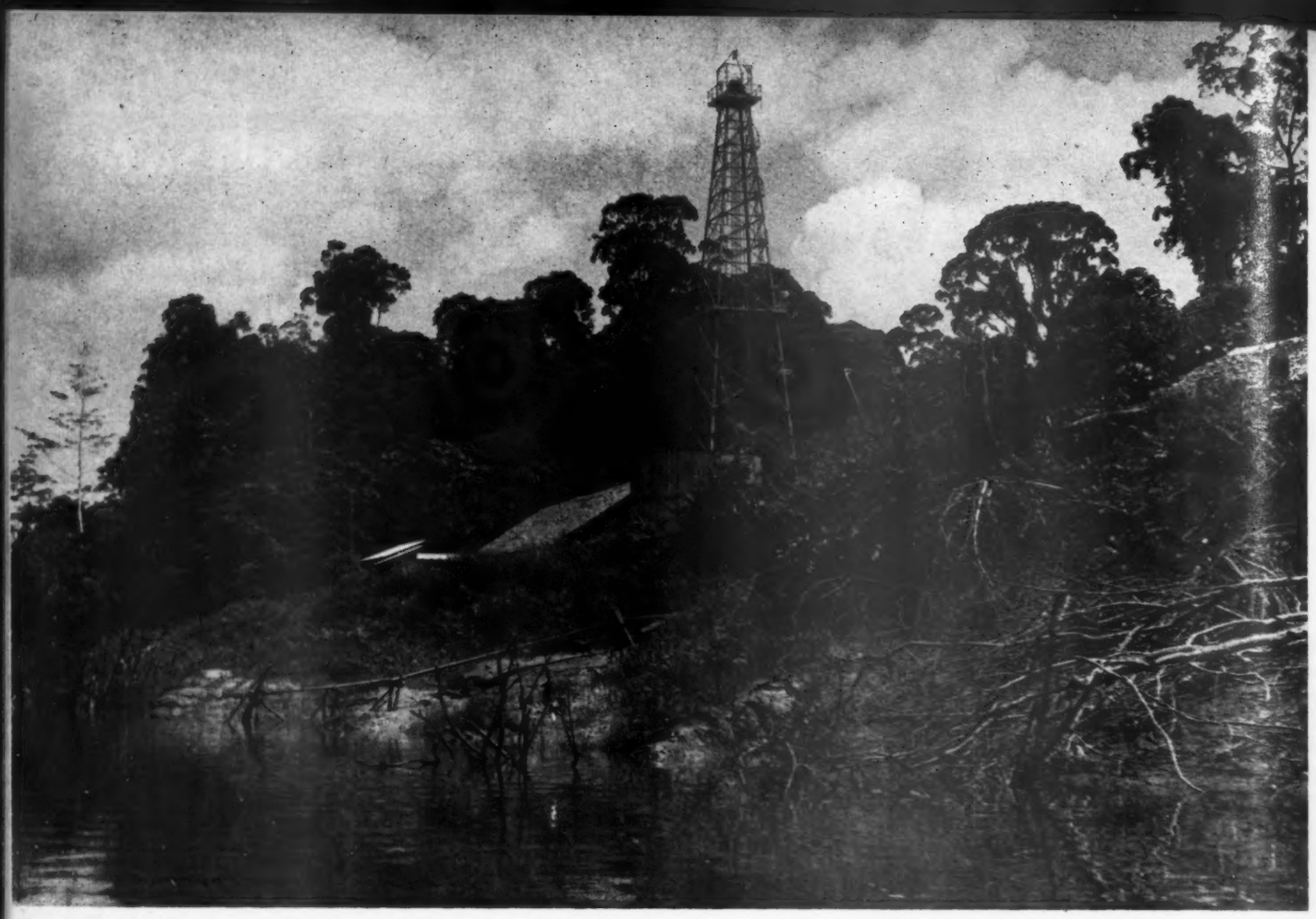

Subis drilling location, which lies half a mile up the Niah river, Sarawak, from the Subis location camp 35 miles from Miri oil fields.

P 162.11
P 420.

British Commonwealth's Largest Field

In the remote state of Brunei, on the island of Borneo, a little known Far East field has climbed to 100,000 bbl a day production

SERIA oil field is situated in the state of Brunei, in British Borneo. Known to few people before the war, this is now the largest single oil field in the British Commonwealth. In 1938, its output of oil, together with that of the Miri oil field in Sarawak, was 6,845,646 bbl but since then the field's production was twice brought to a complete stop—once when the East Indies were invaded by the Japanese in 1941, and again, in 1945, when the islands were reoccupied by the Allies. Today production has risen to more than 37,445,000 bbl a year derived from nearly 200 producing wells.

Seria's Geographic Importance

There is no better way of appreciating the importance of Seria, and of the widespread oil producing area of which it forms a part—the East Indies—than to look at its position on the map in relation to the other major oil producing areas of the world. We see that in the whole Far Eastern area, it is only the East Indies that produces oil in any quantity. The nearest alternative sources of supply are the U.S.A. and the Middle East. Today the U.S.A. cannot spare the shipments she used to make to the Far East before the war, while the output of the Middle East is urgently required elsewhere, chiefly in Western Europe. It is clear then that the countries of the Far East, including India and Japan and also Australasia, must look chiefly to the East Indies for their supplies of of liquid fuels.

History and Development

The Seria oil field was discovered in 1929 after years of detailed geological investigation along the coast and inland swampy jungle bordering the South China Sea. The interior of the island is densely forested, in parts mountainous, and nearer the coast lie swamps into which the unsuspecting traveller can quickly sink. This was the type of territory in which oil men developed the petroleum resources of Seria; they had made such progress by the time of the Japanese invasion in 1941 that 157 wells had been drilled on the land and in the sea and production rate was touching over 14,978 bbl daily. The field extended for more than 5 miles along the beach and to a depth of nearly a mile towards the interior. Off-shore wells had been drilled from jetties built from the beach and extending up to 800 ft out to sea, and the technique of slant-hole—or directional—drilling was employed by the operators to deviate certain of these

Photos courtesy Shell Oil Company

A perahu moored on the banks of the Kemena River at the geological camp.

A jungle survey school trains regional staff and Dyaks in rudimentary survey work. These men, when trained, are able to assist surveyors, geologists, and seismologists. Classes consist of approximately 10 Dyaks and 5 regional staff. The instructor is S. Struiksma from the Technical College of Civil Engineering, Utrecht. Here a Malayan puts instruction into practice.

wells several hundred feet further seawards.

The Seria field yields two types of crude oil—a waxy and a non-waxy—of which the former predominates. About half the production is processed at the Lutong refinery, in the adjoining colony of Sarawak, the balance being shipped overseas. The products derived from the crude by simple distillation and after further treatment are gasoline, vaporizing oil (tractor fuel), gas oil, and fuel oil.

Japanese Invasion

When the Japanese invasion became imminent, plans—prepared as early as 1937—to deny the oil to the enemy were put into effect. All plant and machinery were immobilized, all flowing wells plugged with cement and others rendered useless for some considerable time and industrial buildings destroyed. Important equipment of the Lutong refinery was dismantled and shipped overseas. The area was then evacuated.

Oil output from the East Indies was very necessary to the Japanese war effort and they applied themselves swiftly and diligently to the task of restoring productivity. Their efforts, however, met with indifferent success. In many cases they could not rebuild installations or lacked the knowledge to operate them properly, and later on they had to contend with the damage caused by Allied bombing raids.

War Damage

When they were swept out by Australian forces in June 1945, the Japanese left behind them a trail of utter destruction—wrecked installations, wells, and buildings fired — and oil production ceased entirely for the second time.

G. O. Higgins, until recently general manager in charge of operations in Seria, who arrived in Borneo shortly after the enemy had been driven out, has given a very vivid description of what he saw then. He said, "When we first went in, a pall of thick black smoke from the burning oil hung over a vast area, turning the tropical day into a gloomy twilight. The roar of the gas escaping from the wells was deafening, and it was in this inferno that the Australian Army, with the help of Shell technicians, had to tackle the stupendous task of extinguishing 37 separate oil-well fires. By September of that year—three months after the fires had been started—the last well was brought under control." As Higgins remarked, "We had a big task ahead of us to make good the devastation caused by the Japanese," a task that was further complicated by the difficult supply position and the general inaccessibility of the area. Higgins was awarded a C. B. E. in the 1952 New Year's Honors List for his services in Seria.

Rehabilitation

In spite of these difficulties, however, outstanding progress was soon made. By the beginning of 1946, drilling had begun and, in March 1946, the first postwar cargo of crude oil was shipped for refining at Shell's Clyde refinery, near Sydney in Australia. As materials and equipment from the U.K. and the U.S.A. began to pour in, the tempo of the work increased; old wells destroyed by the Allies and Japanese were brought back into production and new wells drilled; additional pipe lines were laid to connect the oil field to the refinery at Lutong; much of the old refinery there was repaired and a complete new refinery plant brought out from the United States and erected, and the temporary building program was pushed ahead to provide accommodation for the increasing number of employees as well as for stores, offices, hospitals, etc.

Included in the restoration work was the construction of three of the four submarine oil loading lines, each three miles long, used to load tankers that are prevented by shallow water from going closer inshore.

War surplus Bailey bridging material is used extensively on the Seria field in the construction of new roads and here such a road is being built.

Production Rate Leaps Ahead

Until the Lutong refinery came back into operation on December 25, 1946, all the crude oil produced in British Borneo —amounting in 1946 to some 22,467,000 bbl—was exported for refining. After that the rate of both refinery throughput and crude production mounted gradually month by month. The rate of increase in the Seria field was rapid, as the following figures show. Daily production in January 1947 was 14,978 bbl; by June the same year it had risen to 34,224 bbl; by December 1947, 54,413 bbl; by December 1948, 65,154 bbl; by December 1949, 74,890 bbl; by December 1950, 97,537 bbl; until now it has soared to the record level of 104,846 bbl.

Typical regional staff Situfoam bungalow on Seria field. The new Situfoam bungalows are constructed with the maximum of speed from a poured mixture of cement, sand, and a foaming agent. The aluminum forms are lowered into position and the Situfoam mixture poured in by hose.

The Miri Oilfield

Miri, which is the only other oil field in British Borneo, lies in Sarawak, to the southwest of Seria. It is an older field, discovered in 1910, and is now in an advance stage of its life. Its declining importance relative to Seria can be seen from its production record. Before the war the output was about 1,273,130 bbl per year; since the Allied reoccupation in 1945, production, which, as in Seria, had twice been brought to a complete stop, has recovered to only approximately 374,450 bbl annually.

Wildcatting in Sarawak

Meanwhile, intensive geological and geophysical surveys are being carried out over wide areas of Sarawak territory in the hope of finding further likely oilbearing formations. Already, two test wells are being drilled at Bulak Setap and at Subis, south of Miri, and deep in tropical jungle land. The drilling rigs used are capable of reaching a depth of 10,000 ft. The Subis test well is accessible to shallow-draft craft carrying equipment, stores and personnel up the narrow, tortuous Niah river, the entrance to which, from the China Sea, is over a shifting sandbar calling for skillful navigation. Bulak Setap, on the other hand, lacks the advantage of a nearby navigable waterway and it has been necessary to construct a 30-mile road from Miri at a cost of nearly $560,000.

Sterling Oil—Sterling Equipment

It is worthy of note that a large proportion of the material required for this rehabilitation work has been obtained from sterling sources. It has made very little claim upon the U.K.'s limited supply of dollars. Further, British Borneo production contributes materially to the total supply of sterling oil that has to cater for the expanding markets of sterling oil companies.

Under-Water Drilling

Apart from the search for oil on *land*, which has continued apace since the reoccupation—more than 120 new wells have been drilled since 1945—the search has been resumed for oil under the bed of the South China Sea, and if successful it is planned to develop such offshore reserves.

Staff and Labor

The oil company staff in British Borneo of about 1000 is composed of English, Dutch, and Australian, and Malay, Indian, and Chinese (many of whom are locally born) are taking a greatly increasing share of responsibility.

The labor force of about 6000 is largely Malay, Chinese, Indian, and Dyak. As a matter of interest the Indian element is particularly well suited to drilling and all-Indian crews are numerous. Most of the clerical work is done by Chinese and Indians.

As we have seen, British Borneo is a sparsely populated tropical land, and as primary consideration up to now has been given to increasing production, liv-

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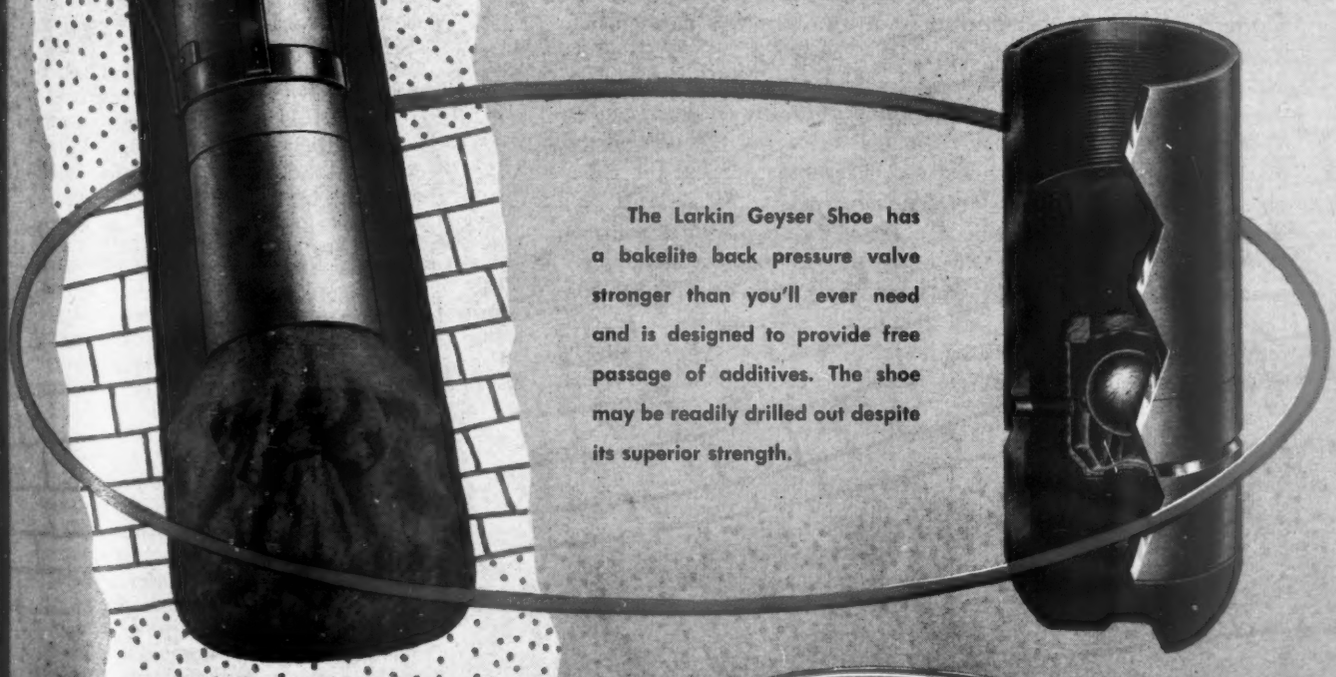

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ing conditions were at first of necessity a little primitive. Nevertheless, the temporary houses—built of palm leaves on a framework of jungle poles—were comfortable and contained such amenities as electric light, running water, refrigerators, and gas cookers.

Now, however, a model township, capable of accommodating over 1500 families, is being built for Shell by a British firm of civil engineers, George Wimpey and Co. Ltd. The permanent houses are being constructed with "Situfoam," a form of cellular concrete that is particularly suited to tropical climates, and there are various types of dwellings according to the different categories of staff and labor. The present housing program, which is scheduled for completion by the end of this year, is made up as follows:

Type of House	Families Program	Families Accomodated Completed by End 1951
Staff	346	252
Labor	1,250	776
	1,596	1,028

Plans for additional accommodation, made necessary by Seria's expansion, are already being worked out.

The existing township includes, of course, such facilities as a hospital, schools, shops, theatres, and offices. To begin with these have been housed in temporary buildings, but are being replaced by permanent structures. Included in the future expansion program is a modern, well-equipped hospital, initially providing 125 beds, but capable of enlargement to 175-200 beds, and a commissary and general stores designed on the self-service principle and combined with an ice plant and cold storage installation.

On the nearby island of Labuan, by the shores of a wide sheltered bay, a rest camp is being built where staff members and their families may stay at weekends and enjoy swimming, sailing, and other sports.

Food Supply

Food supply is somewhat of a problem. Eggs and vegetables can be supplied locally, but canned and cold storage foods must be imported—mainly from the U.K. and Australia. The staple diet of the local population is rice—also imported.

Conclusion

Without oil, Brunei would be a little-known part of the world—with a few traders dealing in rubber and cutch (an extract obtained from mangrove roots and used for tanning); without oil, Seria would be a very small isolated village. This precious liquid, indispensable to modern civilization, brought the oil companies along with their large resources of equipment and technical skill. Whatever importance the area has attained since the war can only be ascribed to the endeavors of these oil men who, in repairing the ravages of war quickly and in the face of formidable difficulties, have made it possible for Seria to make such a notable contribution to the oil resources of the world. * * *

Good Field Data Are Necessary for Good Reservoir Engineering†

JOHN A. MURPHY*

MILLIONS of dollars are being spent each year in research activities directed toward a better and more fundamental knowledge of reservoir performance. The technology of reservoir engineering now embraces the fields of physics, chemistry, geology, mathematics and the not-to-be-disregarded fields of philosophy and metaphysics. In fact, the basic equation relating to the physical aspects of the movement of reservoir fluids is so complicated that it has yet to be adequately solved.

In spite of all this research activity and the millions of dollars spent each year, the reservoir engineer has no substitute for reliable, accurate field performance data. Regardless of the precision of the formulas and their ability to predict the future behavior of a reservoir, the historical data, including oil, gas, and water production and bottom hole pressure, will always be the controlling factors in the studies of oil and gas field performance.

Discussion

It is not a mere presumption that the most important measured basic data relative to the performance of reservoirs are the volumes of oil, gas, and water being produced and the pressure existing in the reservoir. Of course, it is good, and even frequently quite important, to know the relative volumes and the physical and chemical relationship of the oil, gas, and water as they exist in the reservoir. This information, however, is not always obtainable and frequently one has only the measurements of the volumes of the liquids as they are gaged at the surface.

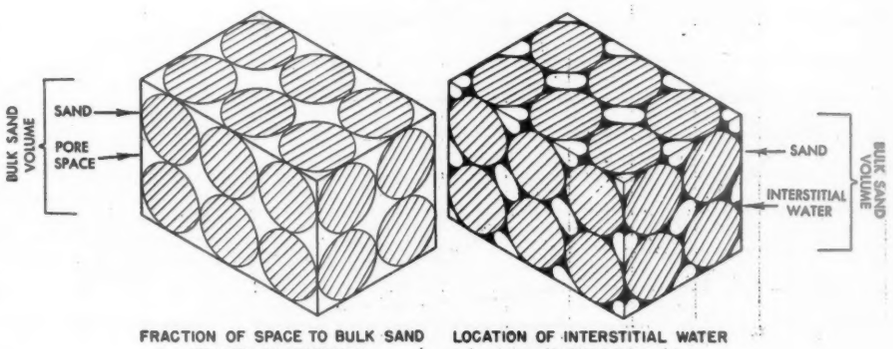
One of the most used (and also misused) theorems of reservoir engineering is the so-called "material balance equation". This states that oil, gas, and water produced from a reservoir *plus* the oil, gas, and water left in the reservoir are *equal* to the oil, gas and water that originally existed in the reservoir. This is a very simple but a very important concept. You will note that 3 of the factors are the oil, gas, and water produced and the accuracy of these factors is the direct responsibility of the field personnel.

It is impossible to discuss adequately all of the uses for reliable field and well performance data; for the purpose of this paper, an attempt will be made to demonstrate the effect of field measurements on reservoir engineering calculations and the resultant decisions of management. First, it might be worthwhile to define several important terms used by engineers and geologists so that their tie-in to field predictions will be better understood.

The two most important characteristics of the reservoir rocks are porosity and permeability. *Porosity* is simply the fraction of void space in the reservoir rock that is capable of containing oil, gas, or water. If one-tenth of the rock volume consists of pores or "vacant spaces" the rock has a porosity of 10 per cent. Most sand reservoirs have from 12 to 25 per cent porosity although some may be as low as 5 per cent or as high as 40 per cent. Limestone porosity usually ranges between 2 and 20 per cent. *Permeability* is defined as the ability of a porous material to transmit fluids, and is a unique property of the size and distribution of the pores. Back in 1856 a gentleman named Darcy noted that the velocity of fluids flowing through sand was proportional to the pressure across the sand and inversely proportional to the viscosity of the fluid; the standard unit of permeability measurement has since been named the Darcy. This unit is too large to describe the permeability of most reservoirs, and the term "millidarcy", or one thousandth of a Darcy, is used for simplicity. If a sand has one Darcy (or 1000 md) permeability, one square foot of sand one foot thick would pass approximately one barrel of oil per day with only a pound pressure drop. Most commercial oil reservoirs have permeabilities in the range of from 50 to 500 md, although some fields produce commercial quantities of oil or gas when the permeability is less than 10 md. Permeability may be infinitely large in the case of large cracks, fractures, or channels in the reservoir rock. Sometimes zones of very low permeability are traversed with fractures that provide wells with very high potentials, although this is in no way indicative of high ultimate recoveries.

Another factor of importance is the so-called "connate" or "interstitial" water content of the rock. Either of the terms may be used although technically connate water refers to the water laid down at the same time as the reservoir rock and interstitial water is the water found in the pores of the reservoir rock when it is first drilled for oil or gas. Interstitial water is important because it decreases the amount of pore space available for oil or gas. This water seldom is produced by wells as it fills the angular spaces at the contacts of the sand grains and usually cannot be displaced under normal producing conditions. It has been found that a relationship exists between the interstitial water content and the permeability of the rock; the "tighter" or the lower the permeability of the rock, the greater the water saturation, expressed as a per-

FIG. 1.



†Presented at the Spring Meeting of the Pacific Coast District, API Division of Production, Biltmore Hotel, Los Angeles, California, May 15-16, 1952.

*Continental Oil Company, Ponca City, Oklahoma.

centage of the pore volume. The usual range of water saturation in commercial oil or gas reservoirs is from 15 to 35 per cent. Some commercial oil sands are known to contain up to 60 per cent water, but these are exceptional; generally, if the water saturation exceeds 45 per cent of the pore space, water will be produced with the oil or gas. (See Fig. 1.)

Certain measurable characteristics of the reservoir fluids are important to an understanding of the behavior of oil and gas reservoirs. Perhaps the most important characteristic is the ability of the oil to contain dissolved gas. This phenomenon is similar to bottled pop containing carbon dioxide. Gas comes out of solution from the oil whenever the pressure on the oil is lowered below the so-called "bubble point pressure". For example, if 500 cu ft of gas are in solution in the oil, the gas will come out of the oil only when the pressure is reduced below about 1500 lb per square inch. This would be called the "bubble point pressure", and the amount of gas dissolved in the oil would be the "solution gas-oil ratio". Frequently the original reservoir pressure is above the bubble point pressure which means that no gas comes out of solution from the oil in the reservoir until the bubble point pressure is reached. Many reservoirs have a "solution gas-oil ratio" of only 5 to 100 cu ft per barrel of oil whereas the oil could contain 300 to 800 cu ft of gas per barrel at the original reservoir pressure. This type reservoir would be called "undersaturated" as the oil does not contain all of the gas that could be dissolved in the oil. (Fig. 2.)

The solution gas-oil ratio is a critical factor in determining the amount of oil that can be produced from a reservoir because the compressed gas may be the only source of energy available to drive the oil to the well bore. Oil expands in volume when gas is dissolved in it. Each barrel of tank oil, containing no dissolved gas, occupies something greater than one barrel of space in the reservoir where it contained dissolved gas. The number of barrels of reservoir space occupied by one barrel of tank oil is called the "formation volume factor". For example, it was mentioned that at 1500 lb

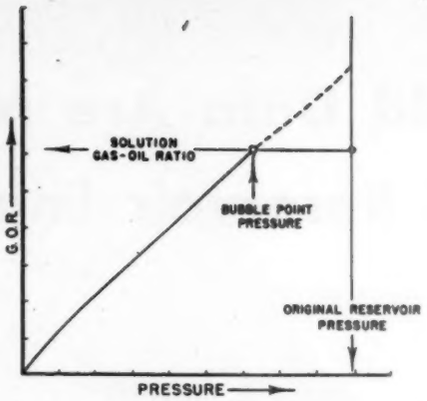


FIG. 2. Chart showing relationship of solution gas-oil ratio to reservoir pressure.

pressure a certain oil could contain 500 cu ft of dissolved gas. As a result, a barrel of stock tank oil would occupy about 1.3 bbl of space in the reservoir. As gas comes out of solution from the oil the oil "shrinks" or occupies less volume. The "shrinkage factor" is merely the percentage reduction in volume of a barrel of reservoir oil as the solution gas is removed from it. Shrinkage factor and formation volume factor express the same idea, but are stated in different ways.

This discussion so far has described some of the important engineering factors that may be useful for predicting reservoir performance and ultimate recovery. There are certain other characteristics inherent to any reservoir that may control to a great extent their development and operation. These are the "driving" or "producing" mechanisms by which the oil and gas are brought to the well bore. There are 3 general classifications of producing mechanisms — solution drive, gas cap drive, and water drive. Many reservoirs will have a combination of two or more of these producing mechanisms. Actually there is a fourth type, gravity drainage; which, although it may be important, is not in the true sense a type of drive. Almost all reservoirs will produce some oil as a benefit from gravity drainage.

The "solution gas drive" also referred to as the "depletion" type or "internal gas expansion" type is the most common producing mechanism. This type drive means that the energy causing the oil to flow to the well bore is derived only from the gas that is in solution in the oil. As mentioned before, oils may hold large quantities of gas in solution at the reservoir pressures and as the pressure is reduced in the reservoir, this gas comes out of solution and expands, causing oil to be driven to the well bore. When the well is opened to production, there is a pressure drop in the sand surrounding the well and the oil and gas just naturally migrate to the well, the point of lowest pressure. A solution gas drive reservoir generally produces the least per cent of the original reservoir oil of all the 3 major drives. Recoveries range in the order of 15 to 30 per cent depending on the amount of gas in solution, the permeability of the formation, and the viscosity of the oil. There is considerable debate at the present time as to whether well spacing is a major item in the per cent recovery to be obtained from solution gas drive pools. So far the answer to that question lies in the realm of philosophy. (Fig. 3.)

The production is characterized by a continuous drop in reservoir pressure and production rate and an increase in gas-oil ratio. The potentials of wells drop off very rapidly but gradually level off to something approaching a 10 to 20 per cent decline in production per year. The gas-oil ratios may increase to approximately 6 to 10 times the original producing gas-oil ratios. The bottom hole pressures decline rapidly and in general about 50 per cent of the reservoir pressure is dissipated when the pool has produced 30 to 40 per cent of its ultimate oil recovery.

It is very important to have accurate field data early in the life of fields of this type. Gas-oil ratios, especially on initial potential tests and shortly thereafter, are essential to the proper planning of field development and the estimation of reserves of oil and gas. Preliminary plans may be made by the management to build a gasoline plant or gas compressing facilities on the basis of early gas-oil ratio data and erroneous data can lead to misspent dollars. In

FIG. 3. Production history for a solution gas drive pool.

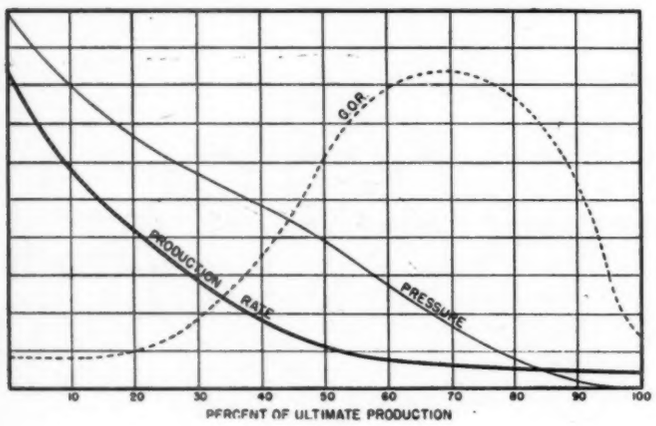
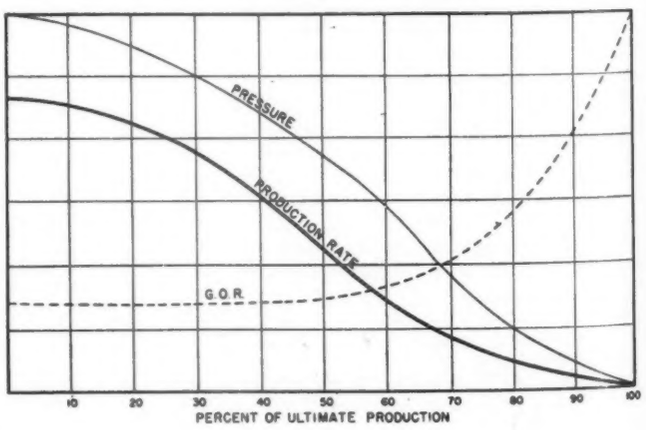


FIG. 4. Generalized performance of gas cap drive reservoir.



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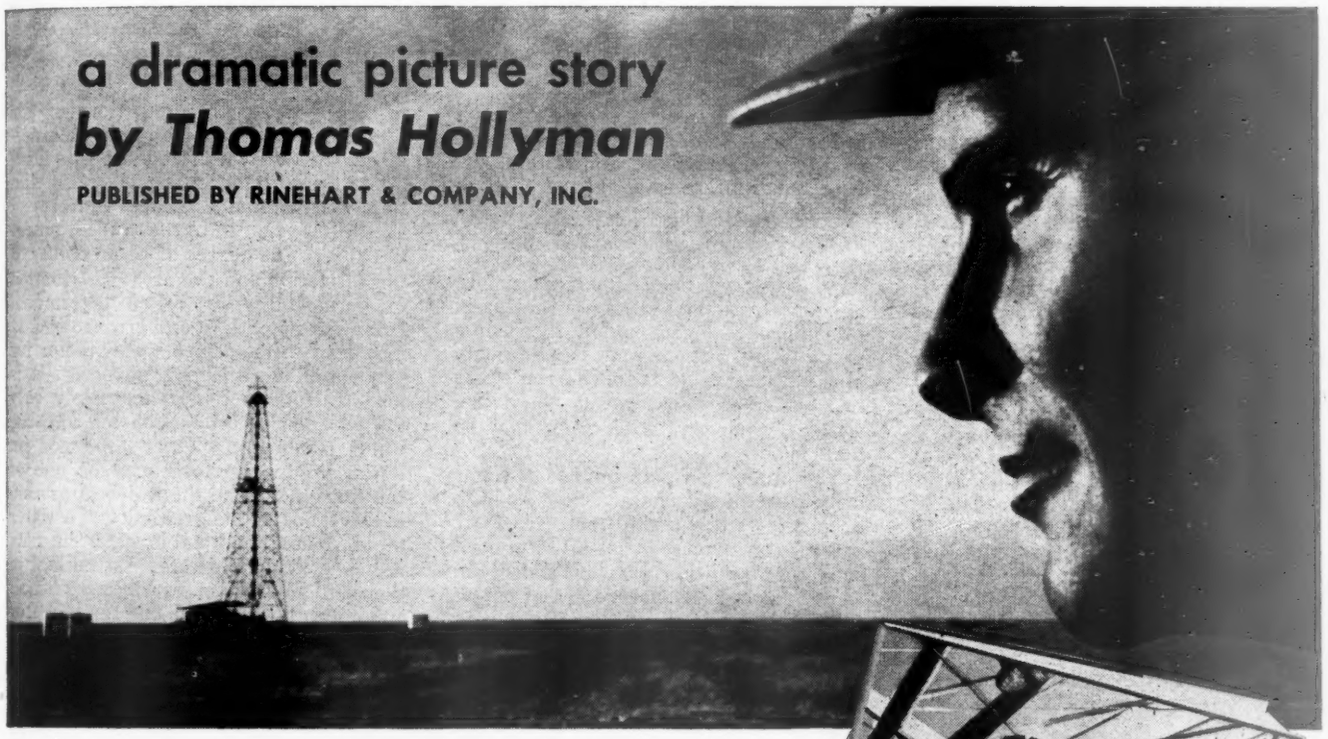

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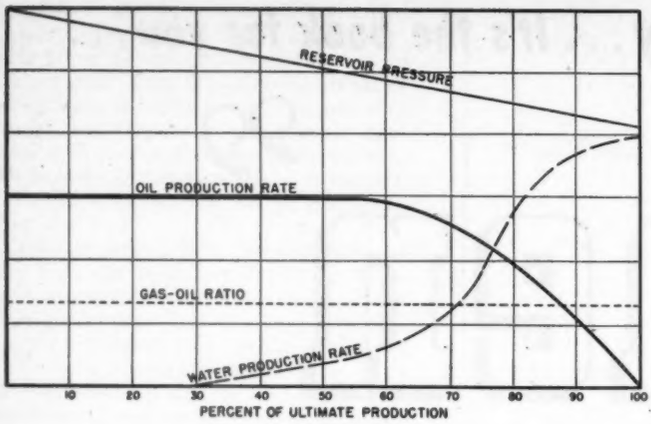

FIG. 5. Generalized performance of water drive reservoirs.

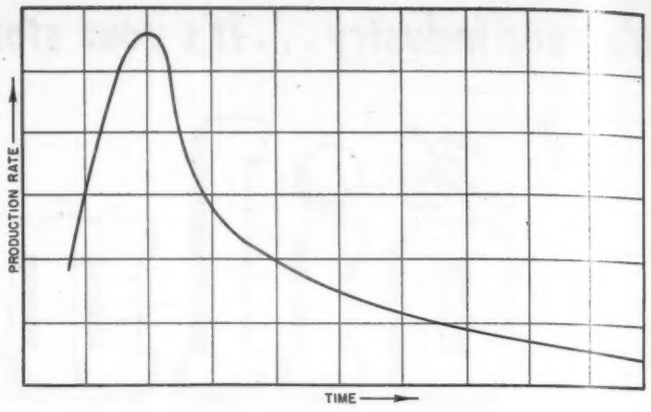

FIG. 6. Decline curve of solution gas drive reservoirs.

solution gas drive fields it is impossible to repeat original producing conditions; from the date of first production, the wells are on the decline.

A second type drive, the "gas cap" or external gas drive reservoir exists where the oil is in direct contact with "free gas" or gas that exists in the gaseous phase in the reservoir. Gas cap drive reservoirs produce a greater per cent of the oil than do the solution gas drive reservoirs due to the additional energy of the free gas. Recoveries may range from 25 to 75 per cent depending to a great extent on the amount of free gas present, as seen in Fig. 4.

Well potentials decline from date of first production but not as rapidly as wells producing from the solution gas drive reservoirs. Gas-oil ratios may remain fairly low during a considerable portion of the pool's life; when they start up they continue to climb until most of the field production is gas. Of course, there are all sorts of combinations of solution gas drive and gas cap drives possible as the former is usually present in a gas cap drive reservoir.

Water drive pools are generally considered to be the most productive in terms of per cent recovery of the original oil. It is not uncommon to have recoveries in the order of from 40 to 80 per cent of the original oil depending on the location of the water and the structural features of the reservoir. Water may enter a reservoir from the edge, in which case it is in contact with only a small areal portion of the reservoir fluid. As the pool is depleted, the water moves horizontally to the producing wells, flushing the oil along the bedding planes. If the permeability of the sand is somewhat constant from top to bottom and the sand is not thick, this type of drive is very efficient and a high ultimate recovery is obtained. If the sand contains some streaks of high permeability, the water may force the oil through these streaks and prematurely reach the well bore. In this case only a small portion of the sand is swept of oil and the water drive becomes inefficient. Remedial work may result in shutting off the watered-out streaks, giving the tighter sands a chance to produce.

Different from the edge water drive is the bottom water drive, wherein the oil zone is underlain by a "table" of water. If the oil saturated section is thin, say from 4 to 10 ft, considerable care has to be exercised in production practice to prevent "coning" of the water into the well. Otherwise the water may move upward to the well before the oil can move horizontally to the well, thus resulting in premature "watering out" of the production. Where a thick zone of oil occurs above a water table and no barrier exists to restrict vertical movement of the water, the per cent oil recovery may be high.

The production performance of water drive reservoirs is characterized by little drop in well potential and reservoir pressure or increase in gas-oil ratio until such time as water cuts are noted. As water production increases the potentials of the wells will decrease although reservoir pressure and gas-oil ratios may remain constant. Typical performance of water drive pools may be seen in Fig. 5.

The foregoing discussion has been primarily concerned with reservoir factors and general performance. Obviously it is impossible to describe all the variations in average reservoir performance and it can always be assumed that no reservoir will be the typical example but some modification of several types. Before the engineer can describe the producing mechanisms of a reservoir it is necessary that he have some historical data in the form of pressure and production measurements. This is where the cooperation of the field man is required and his reliability is a direct factor in the accuracy of the engineering calculations.

The first measurement of the ability of the well to produce is the "initial potential" at which time the oil and gas rates and the surface pressures are recorded. In "depletion" or "solution gas" drive reservoirs this test can never be duplicated and represents, under the proper test conditions, the relationship of the oil and gas under original reservoir conditions. Engineers may often have to correlate laboratory data with the "initial potential" in order to establish the validity of the laboratory measurements. The gas-oil ratio for the reservoir and many predictions of gas production are based on this measurement. Ultimate oil production is a function of the solution gas-oil ratio and thus the original estimates of recoverable oil are tied in to the "initial potential" data. The degree of permeability of the formation and the areal distribution of permeability are often determined from well potentials, and erroneous data may lead to misplaced wells, either for production or injection purposes. It is not sufficient to report accurately only the oil and gas production but also the water production. Water produced on initial production tests may be one of the few clues as to the water saturation in the sands or the proximity of a water table. A small and stable water cut may indicate that the water saturation in the sand is sufficient to allow a small amount to flow through the sand. Water cuts that vary with flow rates may indicate the presence of bottom water or zones of high water saturation. Not reporting water on the initial production or not reporting it accurately can lead to misconceived ideas about the reservoir and subsequent plans for developing the reserves.

Continued accurate measurements of the oil production are required for payment of royalty and oil sales. The engineer makes good use of the oil production data as far as lease production is concerned and with various methods for graphing production data can determine to a fair degree the reserves of oil and the performance of the pool but for many purposes the lease production data are not much help. Well data or at least production data by individual sands are required. A common method for utilizing oil production is to plot monthly oil production against time or against cumulative oil. Naturally if the production is prorated the oil rate will have little meaning. If well potential tests are available periodically, however, these potentials can be plotted on similar graphs to obtain a reasonable idea of the reservoir performance. A typical "decline" curve is shown in Fig. 6.

Gas production, a seriously neglected item, is essential to an understanding of the reservoir performance. Especially is this true early in the life of all reservoirs

and continuing throughout the life of solution gas or gas cap drive reservoirs. Naturally it is difficult to show a payout on the time and expense necessary to measure gas if no gas is sold and such expenditures must be made solely to provide the proper data for evaluation of reservoir performance. In "solution gas" reservoirs the gas-oil ratio is a function of the stage of depletion of the reservoir and a better prediction of reserves can be made if the gas-oil ratio history is known. In all material balance calculations the total volume of production must be known and the gas is a critical item in the volume of production.

Perhaps the gas reserve indicated from the reported gas data is sufficient to support a gasoline plant or indicate that a gas injection program is necessary. Obviously it is necessary that the gas data be accurate before such installations are made. The presence or absence of gas caps is often discovered only by an examination of the gas-oil ratio history. Assume for instance that the gas-oil ratio decreased sharply during the early life of the pool; this would indicate depletion of a gas cap or gas sand. Some minor decrease in gas-oil ratio can be expected early in most fields. If the gas-oil ratio increases above that ratio that may be normal for the type of drive, a coning of gas cap gas into the well may be indicated. There is evidence that gas-oil ratio may be a function of the well production rate—that is, at too high or too low a production rate the ratio may be excessive, but at the optimum rate the ratio is a minimum. This condition probably exists only in reservoirs where there are sand streaks of high and low permeability.

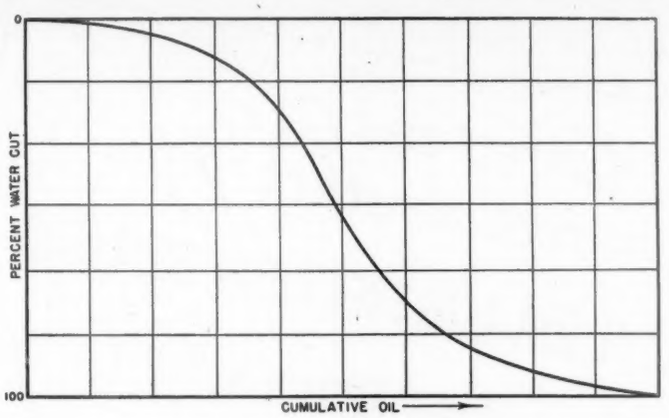

FIG. 7. Water cut performance for bottom or edgewater drive reservoirs.

Without gas measurements many of the above conditions would go unnoticed and perhaps the maximum amount of oil would not be obtained from the reservoir. Without accurate data on gas production the engineer's knowledge of the reservoir is too limited to allow him to provide management with proper recommendations on reservoir control.

Reservoir water is an item that is unsaleable and thus its accurate measurement is frequently ignored. Water, however, is one of the liquids existing in the reservoir and a knowledge of its behavior is essential for understanding reservoir performance. In water drive reservoirs the water production data may be the only factor indicating the reservoir control. A small amount of

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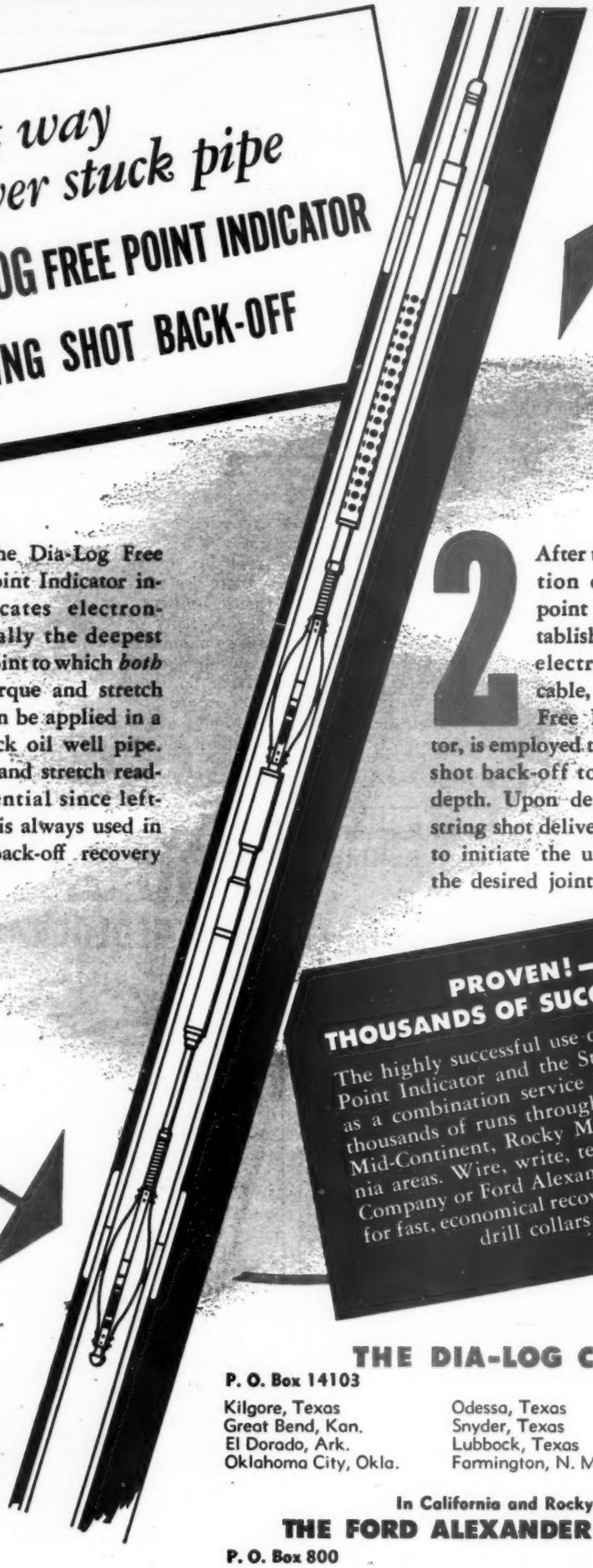

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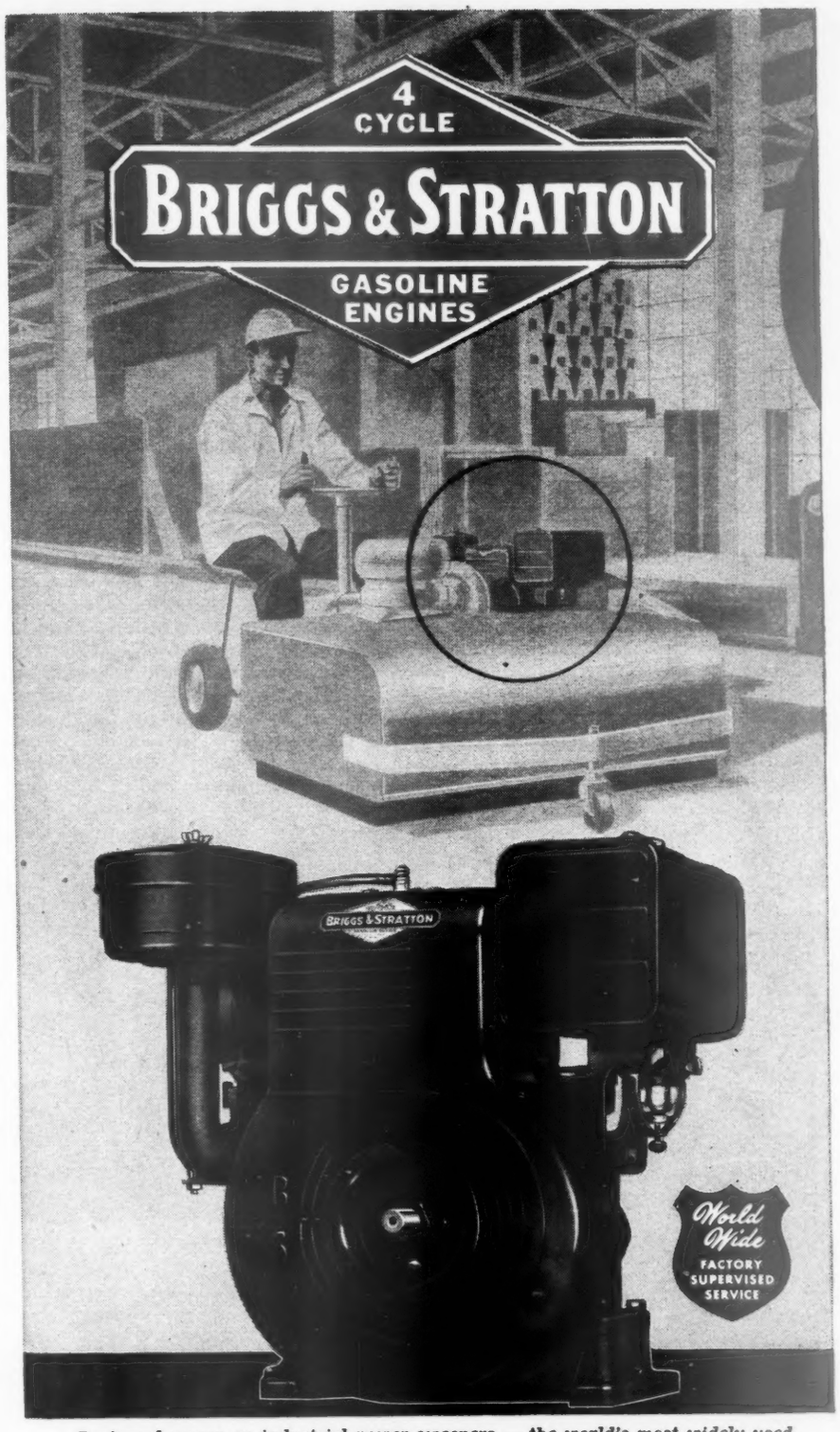
water produced at a constant rate may indicate that the water saturation of the sand is high enough to allow some flow; it may also indicate a small zone of water that contributes to the well a constant rate. If the water is a result of high water saturation in the oil sand it will quite often disappear whereas a water zone may continue to produce. A sudden influx of water can be the result of an edge water drive reaching the well or of water breaking into the well through a water sand as a result of a hole in the pipe or faulty cement job. The general case in a water drive field is where the water increases gradually from 0 to 100 per cent. This is characterized by an S shaped curve when per cent of water is plotted against cumulative oil production. (Fig. 7.)

The curve may be characteristic of both bottom water drive and edge water drive fields. Water entry into a well can be costly, both from loss of recoverable oil and expense of lifting the water. Many approaches are used to control the water. It is first necessary, however, to know where the water comes from, and in many cases a knowledge of the water producing history is the only clue to its entry. Bottom water production can be detected if the per cent of water produced varies with the rate of flow of the oil. The higher the production rate the higher the water cut and if the oil rate is sufficiently reduced no water may be produced. This water is a result of "coning" as the water theoretically has the shape of a cone reaching up from the water table with the peak at the bottom of the well. As the water tables moves upward the oil production rate at which no water is produced decreases and eventually the well must be plugged back. An accurate knowledge of the water cut history of a well is necessary before the proper remedial work can be accomplished. There are many cases on record where a better idea of the reservoir could be obtained and more successful reconditioning jobs could be accomplished if a continuous and accurate record of water production were available.

This discussion has been an attempt to explain some of the engineering factors used in reservoir engineering study. It is important to know some of the reasons for obtaining and accurately reporting the factors that can be measured in the field. It is not sufficient to report "approximate" answers, like estimating water cuts through use of the glass or thumb nail or reporting gas production based on the size of the flares. The answers can be just as wrong if the data are in error as when there are no data. Many serious financial decisions of the management are based on calculations of the engineers and these calculations are not one bit better than the data used. There is no excuse for bad field data. Accuracy of reporting field data is essential.

If the management will provide adequate measuring facilities and the field man will report data accurately, a better knowledge of reservoir performance and many additional dollars profit will be the inevitable result. ★ ★ ★



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NEWS

Eldorado Division Is Incorporated in Canada

The Commercial Products Division of Eldorado Mining and Refining, Ltd., has been incorporated as a division of Atomic Energy of Canada, Ltd., recently, Eldorado announced. This transfer is made to provide a more comprehensive and efficient service for its customers, the company reported. No changes in personnel, established agents, or business routine are involved.

New address is: Commercial Products Division, Atomic Energy of Canada, Ltd., P. O. Box 93, Ottawa, Canada.

Saudi Arabia Reports Oil Production Up in June

Crude oil production in Saudi Arabia during June amounted to 26,970,941 bbl, or an average of 899,031 bbl per calendar day, it was announced by the Arabian American Oil Company. Crude oil output totaled 25,921,576 bbl daily during May.

Crude oil production for the first 6 months of 1952 amounted to 156,264,022 bbl, an average of 858,593 bbl per calendar day.

SEG Plans Sixth Annual Midwestern Meeting

Richard Brewer of The Atlantic Refining Company, Shreveport, Louisiana, has been named general chairman of the sixth annual midwestern meeting of the Society of Exploration Geophysicists, F. G. Knight, of Ohio Oil Company, president of the Ark-La-Tex Geophysical Society, reported. The meet will be held November 13 and 14, 1952, in Fort Worth, Texas, Knight said, and will be sponsored by the Fort Worth, Dallas, Midland, Tulsa, Oklahoma, and Shreveport local sections of the SEG with the Shreveport group in charge of arrangements.

Leslie C. Spencer, consulting geophysicist and secretary-treasurer of the Ark-La-Tex society, is chairman of the technical program committee for the meeting, and will be in charge of accepting papers for presentation. B. B. Burroughs, of Sunray Oil Company, and vice president of the Ark-La-Tex society, is chairman of the housing committee, and will be assisted by F. O. Mortlock, of Gulf Research and Development Company, Fort Worth. Other committee chairmen in Shreveport are Bryan Duby, of Carter Oil, finance committee; Roy Fischer, consulting geophysicist, entertainment committee; and E. A. Malone, Gulf Research and Development, registration committee.

Brewer received the degree of BS in electrical engineering from Purdue University in 1935. He joined Atlantic Refining in 1946.

New Wells Scheduled For Tejon Hills Field

Contracts have been let for drilling of 25 more wells in the Tejon Hills field, Kern County, California. Twenty-two producing wells pumping 700 bbl of oil daily have been drilled in the field to date. Oil is producing from depths of 500 to 600 ft.

Sunset Oil Company recently announced that it has purchased from Tejon Hills Oil Company lease of 1623 acres in the field.

Canadian Subsidiary Set Up

Incorporation papers have been filed for Canadian Bishop Oil, Ltd., which will operate as a Canadian subsidiary of Bishop Oil Company.

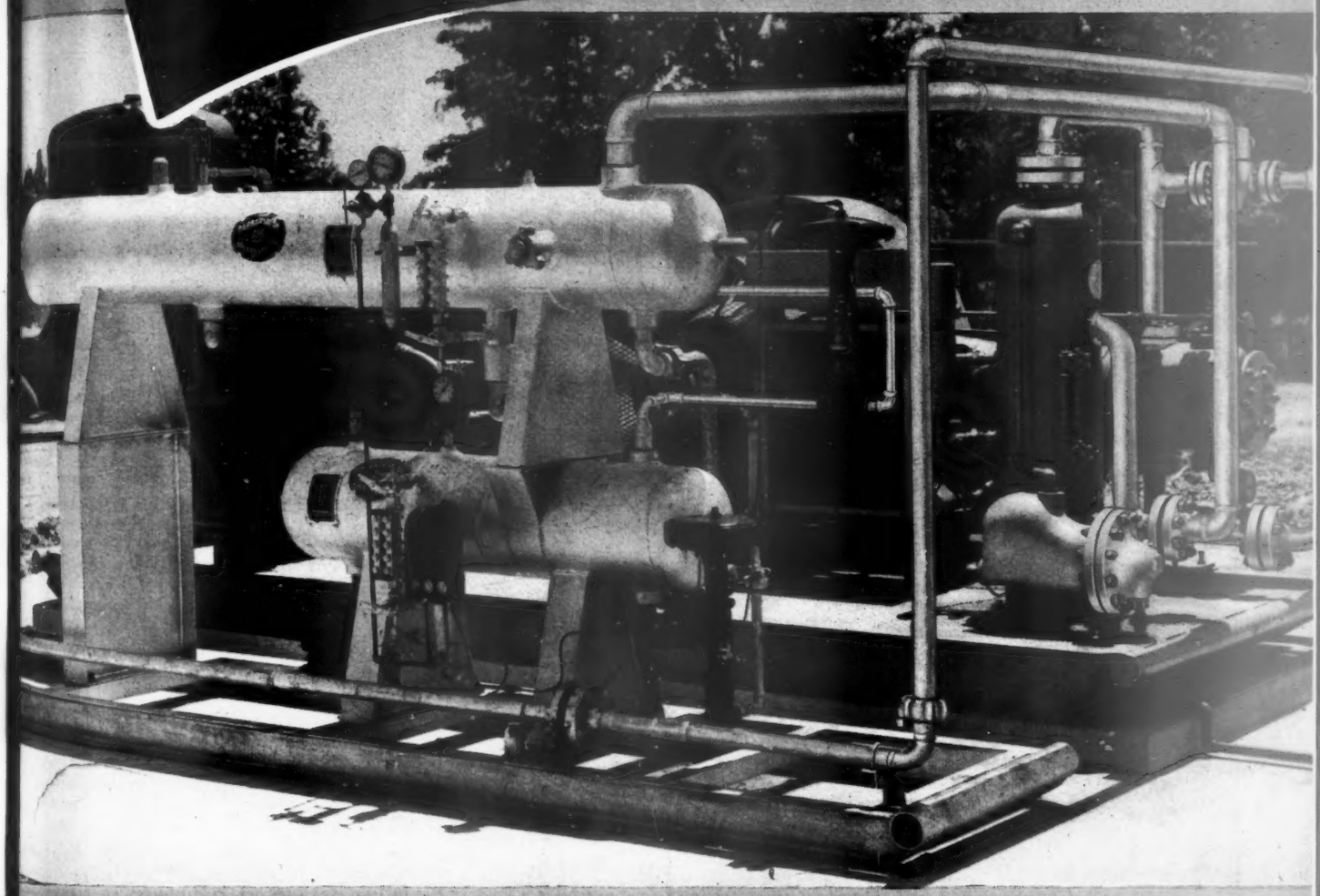
Through its new Canadian subsidiary the oil company is looking toward the acquisition of extensive acreage in Alberta, Saskatchewan and Manitoba provinces, vice president and general manager Louis J. Brunel told a meeting of the company's geologists and engineers.

Guests of Los Angeles Nomads meeting recently were (below): R. E. de Mestre, Bahrein Petroleum, Bahrein; W. H. Clisby, Iraq Petroleum, Iraq; Fred Edmonds, Bethlehem Pacific Steel; Charles A. McKeand, M & M Association, California. Front row: Lionel W. Wiedey, Standard Jersey, formerly in Colombia; B. Clyde Enyart, Aramco, Saudi Arabia; George Emerick, Burmah Oil, Burmah; M. T. Shawky, Anglo Egyptian Oil Fields, Egypt, and Albert J. Dodini, Bahrein Petroleum.

Ritual and induction ceremonies were presided over by Hi Cassidy, McCarty Company, at the L. A. meeting. Inductees are: Earl Tavan, Ken Corporation; Roy Boydston, Martin Decker Corporation, and Rex Collins, Hydril Company. Speaker of the evening was Charles A. McKeand, director of Merchants and Manufacturers Association of California, who gave a brief survey of the steel situation.

PARKERSBURG LIQUI-TRAP AND BY-PASS ASSEMBLY

for booster compessor stations



For the first time, the industry has a specially designed and completely unitized assembly for trapping and re-combining liquid at booster compressors. In addition to increased process efficiency, it has the advantage of flexibility, in that it can be supplied with a water knockout if desired . . . is available without main separator for use with your stock vertical or horizontal separators.

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For safety, exhausted gas charge from the accumulator is re-scrubbed, in main separator before re-entering compressor.

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Secondary Recovery in Kentucky Summarized

Interstate Oil Compact Commission announces the publication of a pamphlet entitled "Summary, Secondary Recovery Operations in Kentucky to 1951 Including Annual Kentucky Oil Production by Counties." This publication is the result of a joint survey by the state of Kentucky and the Interstate Oil Compact Commission and was prepared by Dan J. Jones, chairman of the Kentucky Secondary Recovery Committee and members of that committee in cooperation with the Secondary Recovery Division of the Interstate Oil Compact Commission.

This pamphlet includes data on 17 secondary recovery projects in Kentucky as of January 1, 1951, together with a brief history of the production of oil from Kentucky and early secondary recovery operations as well as future prospects.

California April Output

Production in California during the month of April averaged 980,635 bbl daily, a total of 29,419,036 bbl, according to a report by the Conservation Committee of California oil producers. Gas production for the month totaled more than one billion cubic feet daily, with gas oil ratio 1,560. Total number producing wells were 29,997, with number of new well completions reaching 140.

R. V. Welch, field superintendent, Imperial Oil, Ltd., Leduc-Woodbend field, Alberta, Canada. Total average daily field oil production in this important oil field is 60,000 bbl and some 23,000,000 cu ft of gas. Imperial's operations constitute a large portion of the entire oil field. Welch is in charge of 16 active drilling rigs.

Rice Institute to Have Seismological Station

Donation of $25,000 by four geophysical exploration companies toward establishment of an earthquake seismograph station at The Rice Institute, Houston, Texas, has been announced by the Society of Exploration Geophysicists. The gift was made by General Geophysical Company, Independent Exploration Company, Robert H. Ray Company, and Seismic Explorations, Inc., all of Houston.

The money will be used to provide the equipment for a seismological station for the continuous recording of the movement of the earth and earthquakes anywhere in the world. It will be the first such station to be established in the Houston area, and in cooperation with other stations such as those at the California Institute of Technology in Pasadena and at Saint Louis University, will make possible the directional plotting of earth waves.

Township Maps Available

Abstract Township Map Company has announced that it has just completed the first series of township maps covering McKenzie County, North Dakota. The series comprises a total of 92 separate maps 24 by 24 in. with sections on the scale of 3 in. to the mile. Maps include information as to land ownership, lease ownership, mineral ownership, etc.

CORRECTION

An error in the manuscript was made in the July 1 issue of *The Petroleum Engineer*, Page B-87, "Effect on Oil Recovery of LPG Injection." The second equation should read:

$$R = X$$

instead of

$$R = \frac{1}{1\text{-}X}$$

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Houston Nomads Visit Smythe Home. Charles M. Smythe, E. W. Saybolt Company, entertained the Houston, Texas, chapter of Nomads at his bayshore home at LaPorte, recently. Above are the host, Smythe; Dr. Manuel Mier, Empresa Colombiana de Petroleos, Bogota, Colombia, S. A., the only foreign guest; and W. A. "Red" Davis, Davis-Lynch Sales and Engineering Company.

Aerial Survey Made of Northwestern Canada

More than 85,000 sq miles in western and northwestern Canada will be mapped with the airborne magnetometer this summer. This vast reconnaissance work is being done for several oil companies by Canadian Aero Service, Ltd., of Ottawa.

Areas in Saskatchewan, the Northwest Territories, Alberta, and British Columbia, will be mapped by three air survey crews. It is expected that the aeromagnetic studies will produce valuable data concerning basement depths and structures. These facts will aid the search by the seismic and gravity crews, routing them to areas of greatest interest this fall and winter.

Monterey Assumes California Oil Operations

Monterey Oil Company has taken over the California operations of its subsidiary, Jergins Oil Company, it was announced by Lowell Stanley, chairman of the board. No change in management or personnel is involved in the move, which was made in the interest of corporate simplification.

Officers of the Monterey Oil Company include in addition to Stanley, chairman of the board: Howard C. Pyle, president, and E. E. Pyles, vice president and director.

The company operates in Texas and Oklahoma through a subsidiary, the Monterey Oil Company of Texas, and is a producer of crude oil and natural gas, with a current net production of 9000 bbl a day.

Executive offices of the firm have been moved to the Statler Center Office Building in Los Angeles, and a new building nearing completion at Signal Hill, will provide additional offices.

Other officers of Monterey Oil Company are J. H. Abramson and C. R. Pickering, vice presidents; C. W. Pierce, treasurer; M. E. Dunn, comptroller, and R. R. Rusmisel, secretary.

Ashland Billings Office

Roy B. Ralston, manager of exploration and production for Ashland Oil and Refining Company, announces the opening of a new division office in Billings, Montana, by the company. John B. Nunn, formerly landman in Ashland's Henderson, Kentucky, division is moving to Montana to assume the duties as division landman for the new division. Milton Kuhleman, now geologist at Henderson, Kentucky, will be division geologist.

International Geological Congress To Meet

The International Geological Congress will be held at Algiers, Algeria, September 8-15. Scientists at the Congress will discuss a wide range of subjects including submarine topography, the geology of the Mediterranean, and Middle Eastern areas, and the hydrology of arid regions. Many of them will study geological conditions firsthand in various parts of North Africa, including the Algerian Sahara and the Atlas Mountains. Anglo Iranian Oil Company has announced that its chief geologist, Dr. G. M. Lees, president of the Geological Society of London, will attend the Congress.

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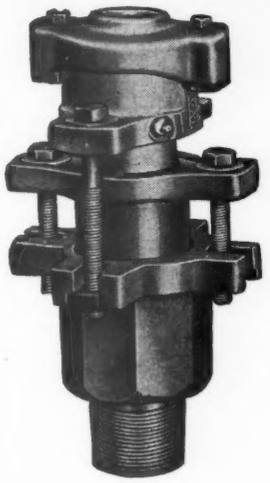

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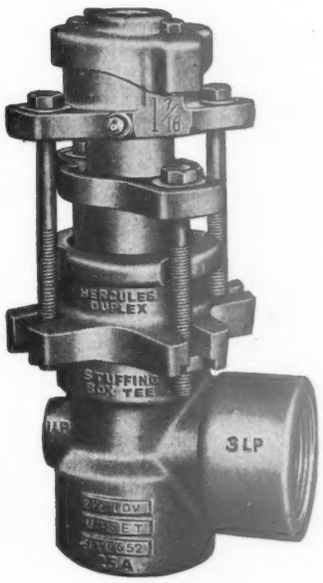
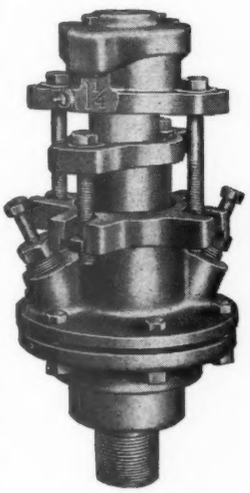


A double packed Stuffing Box for use under most adverse pumping and flowing conditions (below). Be sure to order Type A-123-SBDP.



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What's Doing in Drilling

Two Gas Discoveries Made In Peace River Area

A new discovery, the Canadian Fina-Royalite Gordondale No. 2, which lies about 12 miles southeast of the Pouce Coupe gas field astride the British Columbia-Alberta border, has been made. In drillstem tests of the Cadotte formation gas flows totalling 9,000,000 cu ft were received over an interval of 15 ft (2842-2857 ft). This well has been completed as a gas producer.

A second discovery has also been made in this area, Pacific-Gas Exploration Rycroft No. 1. This well is being drilled by Pacific Petroleums, Ltd., and Gas Exploration Company. In a drillstem test of the top 10 ft of the Cadomin formation (4170-4180 ft) gas flowed at the rate of 3,220,000 cu ft per day.

Gas-Distillate Well Is Brought in by Ashland

A new gas-distillate reservoir has been reported for Darrow field, Ascension Parish, Louisiana. It is The Texas Company and Ashland Oil and Refining Company's No. 3 Gulizzo Unit 2, which flowed at the rate of 2,500,000 cu ft of gas plus 60 bbl of 52 gravity distillate through 12/64-in. choke. Tubing pressure was 3340 psi with sealed casing. The well was drilled to a total depth of 9232 ft.

New Driver-Spraberry Well

The Glasscock section of the Driver-Spraberry field has been extended one mile north with completion of Sinclair Oil and Gas Company's No. 1-C TXL-Glasscock. The well has been given a flowing potential of 570 bbl of 37.6 gravity oil for a 24-hr period. Gas-oil ratio is 780 to 1. Production, which is from 6744 ft and 6850 ft, is through open 2-in. tubing and open hole. Total depth is 6850 with top of production at 6750 ft.

Carter Well Completed In Beaver County Pool

Production in the Greenough pool of Beaver County, Oklahoma, has been proved with completion of Carter Oil Company's second offset to the pool opener. It is the Carter and Emby Kaye No. 1 Sharp, which is flowing from the Oswego lime, the discovery zone. The first offset missed the producing zone.

Kansas Field Well Assured

Southwest extension of the newly-discovered Southeast Benson pool of Pawnee County, Kansas, was assured recently when Cities Service Oil Company's Becker B No. 4 flowed oil on a drillstem test in the Lansing-Kansas City limestone from 3721 to 3749 ft. The field discovery, Cities Service Becker B No. 2, was completed as a Lansing-Kansas City producer for a 1928-bbl initial.

Steel Shortage Causes Rotary Rig Activity Slump

The prolonged steel strike has been blamed for the fourth straight week's slump in rotary oil well drilling activity in the United States and Canada, as reported by Hughes Tool Company. Active rotary rigs totaled 2700 at the end of the week, July 14, as compared with 2748 for the same week last year. It was also the lowest figure since June 25, 1951.

Some drilling contractors expect many more rigs to be idle, perhaps as many as 300 even though the steel strike has ended. They point out it will take many weeks for steel mills to get back into full production and distribution after the strike ends. Sharpest cutbacks according to the report were seen in the West Texas-New Mexico region, and the Oklahoma-Kansas region.

Below is a report of rotary rigs activity in the last 5 weeks, as reported to The American Association of Oil Well Drilling Contractors by Hughes Tool Company.

Weeks	Total	Gulf Coast	Pacific Coast	Illinois Oklahoma Kansas	West Texas New Mexico	Rocky Mountain Canada	Arkansas Louisiana Texas	North Texas
(June)								
Third.....	3032	603	169	698	654	427	161	320
Fourth.....	2959	614	168	658	632	416	160	311
Fifth.....	2850	561	163	652	604	412	144	314
(July)								
First.....	2800	561	162	630	572	417	146	314
Second.....	2700	564	162	593	537	407	144	293

E. C. "Ned" Brown, president of Brown Drilling Company, wishes Allen Dysart, left, "bon voyage" on the eve of his departure for Australia. At right are Mrs. Dysart and Luann Dysart.

Brown Drilling Will Test Western Australian Area

Brown Drilling Company has been awarded a contract to drill in Western Australia for the California Texas Oil Company, Ltd. The drilling equipment, parts and supplies for the operation are now enroute to Australia. This equipment (weighing something like 3000 tons and capable of drilling to 15,000 ft) was completely unitized in California.

Drilling personnel for this project are all taken from Brown Drilling Company's California organization. The project will be headed up by Allen Dysart, drilling superintendent, who has had several years experience in the Middle East in like capacity.

It is anticipated that the first test well will be drilled to considerable depth in order to test out the prospective sedimentary rocks of this area.

The North West Basin, in which the drilling will take place, is a vast semi-desert tableland beset by large stone outcroppings and spinifex, a porcupine grass which cuts like a razor. In addition, there is a hot sun, only dirt roads and, at certain seasons, monsoons, which blow in from the Indian Ocean.

The following men are now enroute to Australia to supervise the offloading, proper warehousing, assembling, etc., of the equipment upon its arrival: Allen Dysart, superintendent; David Smith, clerk; Albert Sturman, mechanic; Virgil Abney, driller; Charles Kemp, driller; and Lee White, assistant driller.

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Its long, narrow teeth taper toward the inside, and while digging, guide the junk to the center of the opening so it easily can be forced up into the barrel. Once in the barrel, or even partly so, the strong catcher dogs hold it securely for the trip out of the well. Also, the barrel has an extremely large capacity, carries a big load, and requires a minimum number of round trips to recover a given amount of material . . . makes tough jobs look easy.

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To obtain more information on products advertised see page E-45

Drilling

Ohio Completes Field Well

Ohio Oil Company has completed its No. 1 Coleman-Powe in Forrest County, Mississippi's Maxie field. The well flowed 8,113,000 cu ft gas plus 167 bbl of 59.6 gravity condensate per day through 25/64-in. choke. Tubing pressure was reported at 2453 psi and casing pressure at 2754 psi. Gas oil ratio was 48,569 to 1. Total depth of the well was 9006 ft, with production coming from 7303-20 ft.

Wet Gas Find in Canada

A wet gas discovery has been reported by Canadian Delhi Oil, Ltd., at Delhi-Britalta Winchell Coulee No. 1, about 40 miles northwest of Calgary. The well topped at 8440 ft, and is the second gas zone in the Jumping Pound sand. Production casing has been run. The well discovered substantial amount of wet gas in the Cardium around 5235 ft last March, establishing an estimated potential of 10,000,000 cu ft daily.

Shallow Production Sought

Crescent Drilling Company is seeking shallower production in the Sicily Island field of Catahoula Parish, Louisiana. Present production is from the Lower Tuscaloosa, and no production wells have been brought in from the Wilcox, object of Crescent's proposed well, the No. 4 Tensas Delta. Wilcox production is about 6000 ft. Production from the field is oil and gas condensate.

Sohio Well Proves McLish Sand Production

McLish sand production has been proved at Sohio Petroleum Company's No. 1 Henderson on the west side of the Eola pool in Garvin County, Oklahoma. The well flowed 227 bbl of oil in 6 hr from 10,414 ft. Gas-oil ratio was 874 to 1. Oil was 36.3 gravity. McLish formation was hit at 10,288, with well drilled to a total depth of 10,414 ft.

Miocene Sand Hit in Wheeler Ridge Pool

Richfield Oil Corporation has discovered its second oil well in the Wheeler Ridge pool, in the south end of San Joaquin Valley, California. The well, KCL 76-29 flowed at the rate of 1114 bbl daily of 44 gravity crude oil through a ½-in. choke. It also produced gas at the rate of 1,100,000 cu ft daily in the 2-hr and 23-min test. Flow is from an upper sand zone between 6300 and 6500 ft, which Richfield believes to be of lower Miocene age.

Gulf Well Completed In Alabama Field

Gulf Refining Company recently brought in its first oil well in Alabama's Pollard field, in Escambia County. It is the company's T. R. Miller Mill Company No. 1, which was completed for a daily flow rate of 116 bbl of 29.3 gravity crude through a 7/64-in. choke. Flow is from the lower Tuscaloosa sand formation at 5834 ft to 5860 ft. Tubing pressure was 440 lb. This well is the sixth producer for the field.

Illinois Field Extended

Extension of the West Ruark pool of Lawrence County, Illinois, was reported when Cities Service Oil Company's McCarty No. 1 produced 371 bbl of oil during a 24-hr initial production test. The well is producing from perforations in the McClosky limestone from 2374 to 2380 ft and from a section in the Benoist sandstone, hydrafraced from 2219 to 2225 ft. It will be dually completed. This is Cities Service second producer in this recently-discovered pool.

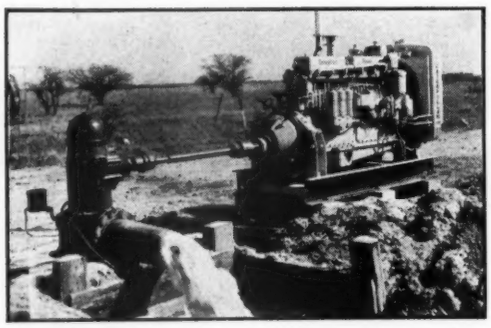
Conoco Elkhorn Well

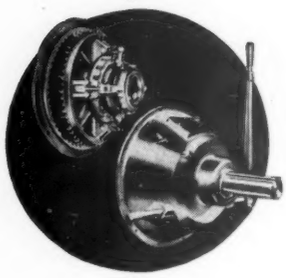
A new well, Continental Oil Company's No. 15-A Shannon, has extended the Elkhorn Ellenburger field of Crockett County, Texas, ¼ mile south. The well has been completed for a calculated daily flow of 682 bbl of 41.7 gravity oil. Potential was based on actual 10-hr flow of 284 bbl of oil through a 46/64-in. tubing choke, and perforations between 7282 ft and 7368 ft. Gas-oil ratio was 475-1. Total depth is 7429 ft.

Elk City Pool Gets Well

Shell Oil Company has completed its No. 3 Summers, gas-condensate producer in the Elk City pool of Beckham County, Oklahoma. The well, plugged back to 10,495 ft, flowed 415 bbl of condensate with 2,792,000 cu ft of gas in 24 hr through a 22/64-in. choke.

This Engine Produces





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ROCKFORD CLUTCHES

New Well Recovers Oil In Fort St. John Area

Pacific Petroleums has reported that Pacific Fort St. John No. 8 well, in the testing interval of 4493-5403 ft, (Triassic sands), brought gas to the surface in one minute, and oil to the surface in three minutes. Estimated rate of gas recovery was 10,000,000 cu ft, while pipe recovery showed 1380 ft of clean oil. Estimated gravity of the oil is 40 deg.

The number eight well is 5¾ miles northwest of Fort St. John No. 4 well, in British Columbia.

Waterflooding Set for Portion of Cut Bank Field

The Texas Company, Union Oil of California, and Phillips Petroleum Company have announced their intentions to waterflood the Cut Bank field in northern Montana. The experiment is being done in an effort to halt the downward trend in the field's production, officials announced. The Cut Bank sand reservoir has been unitized over a 640-acre area with Texaco as unit operator. If the initial unitized area proves successful, ultimately the entire field will be included in similar unitized tracts.

Gas Well Said to Be Largest in Utah

Three States Natural Gas Company has reported a new producing sand in Clear Creek field of Carbon County, Utah. Site of discovery of new area is the Utah Fuel Company No. 3, gas well said to be the largest in Utah, where about 5,000,000 cu ft of gas per day has been encountered. The well, according to James Edson, division geologist, proves at least 7 different productive members in the Ferron sandstone.

Florida Test Passes 5000-Ft Depth Mark

Sunnyland Contracting Company reports it has passed the 5000-ft mark in its second wildcat in Santa Rosa County, Western Florida. This well is the No. 1 Mrs. W. H. Nowling, where the operator proposes to drill to 7000 ft, believed deep enough to tap the Lower Cretaceous formation. This is the same formation that has proved productive a few miles north of the well in Escambia County, Alabama.

Skelly Adds Well to Milroy

Skelly Oil Company is finding good production in the Milroy pool, Stephens County, Oklahoma, at its No. 2 Horton. The new well flowed 158 bbl of oil in 24 hr through a ¼-in. choke from plug-back depth of 2668 ft.

Beaver Lodge Pool Adds Well

Amerada Petroleum Corporation is extending the Beaver Lodge Madison pool in North Dakota two and one-half miles north, with completion of its No. 1 Leroy Nelson. The extension well flowed 133 bbl of 42 gravity oil in 3 hr on a drillstem test from 8384 to 8420 ft, and 1,200,000 cu ft of gas a day.

Shell Gets Prolific Elk City Field Well

An especially large oil well has been brought in in the Elk City field of Beckham County, Oklahoma, where Shell Oil Company has completed its No. 2 Pyle. The well flowed 923 bbl of 43 gravity oil in 24 hr through a 22/64-in. choke from perforations between 9802-9902 ft. Plugged back depth is 9925 ft. Gas oil ratio is 2525 to 1.

New Zone Productive In West Davenport Pool

A new zone has proved productive on the west side of the West Davenport pool in Lincoln County, Oklahoma. The Davis, Morrison, and Weitzenhoffer No. 1 Parris flowed 66 bbl of oil in 11 hr through a ¼-in. choke. Sand was perforated at 3998 to 4004 ft. Total depth of the well is 4068 ft with casing set at 4058 ft.

Extension Well Given California Gas Area

Reserve Oil and Gas Company has announced completion of its Kern County, California well, Drilling and Production Company's No. 38-A-33. The new well indicates a westerly extension by a quarter mile of the gas zone discovered in that area last year. Completed from 4812 ft, the new well is flowing wash oil and gas, and at last report accurate gage had not been taken.

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REMOVABLE PRODUCTION EQUIPMENT

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★ **REMEDIAL WORK**—Correction of gas, oil ratio, positive water shut-off and plug-back is made efficiently with SECURALOY Production Equipment.

★ **DEVELOPMENT WORK—SECURALOY** windows positioned in casing permit maximum recovery when removed. May be used to seal off secondary zones which may be opened for future production.

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★ **SECURALOY** pipe may be used for tail pipes, bailers, tubing string or almost anywhere in the production string where steel could become stuck and require an expensive workover or force abandonment.

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Exploration Activities

Shell Adds New Well To Williston Basin

Shell Oil Company has apparently made a new Williston Basin discovery at its No. 1 Little Beaver in Fallon County, Montana. The wildcat swabbed 97 bbl of oil during the first 29½ hr of a 34-hr test. During the final 5 hr the recovery was 85 bbl of liquid, of which 81 bbl was 30 deg gravity oil. The well is 50 miles southeast of Shell's Pine unit discovery, is situated at the extreme southern end of the Cedar Creek anticline.

Alberta Gas Find Reported

Prado Oil and Gas, Ltd., and Rio Tinto Alberta Oils, Ltd., have reported a marginal light oil discovery and a gas discovery in the Lower Cretaceous in Alberta. Prado Chauvin No. 8-28, 30 miles south of the Lloydminister heavy crude field, is the discovery. The well tested 2122 ft in Lower Cretaceous for gas at an estimated rate of 6,000,000 cu ft daily, and a recovery of 20 ft of oil cut mud. Electrologs run at the well have indicated three separate zones. Production casing has been run and production tests will be made.

Bishop Completes Two Kansas Oil Producers

Bishop Oil Company has announced two Kansas wells, the Bieberle No. 6, in Rice County, and Petrowski No. 3, in Pratt County. The Bieberle well was brought in for initial daily production of 50 bbl of 40 gravity oil from a total depth of 3245 ft. Initial production of the Petrowski well was 1,500,000 cu ft of gas and 9 bbl of 40 gravity oil per day from a total depth of 4304 ft.

Deep Rock Well Hits Oil in Illinois County

A Schlumberger test is being run at Deep Rock Oil Corporation's No. 1 H. Vaught, wildcat well in White County, Illinois. The well, drilled a total depth of 3155 ft, recovered 1710 ft of oil and 30 ft of oil-cut mud on a 67-min drillstem test from 2801 to 2808 ft. Bottom hole pressure in 23 min was 1000 lb. Well is about 1½ miles from other producers.

Scurry County Well Shows Signs of Ellenburger Flow

Superior Oil and Intex Oil Companies' No. 13-578 R. J. Jordan in Scurry County, Texas, shows good promise for prolific Ellenburger production. The new well was drilled to 8360 ft in the Ellenburger, where recovery was 180 ft of free oil. The hole was deepened to 8370 ft in Dolomite where a 90-min test was made at 8360-70 ft. Gas showed to surface, and stem recovery was 7900 ft of free oil. Bottomhole pressure was 2730 lb.

Anadarko Well Opens New Beaver County Pool

Carter Oil Company has apparently opened a new oil pool in Beaver County, Oklahoma, in the Anadarko Basin, at its No. 1 Dorman. Lime was hit in the pool opener at 5263-76 ft, in the wildcat that is four miles south of the Greenough field. On a 2-hr drillstem test, 3150 ft of gas was recovered in drill pipe, 100 ft of 38.5 gravity oil, and 10 ft of heavily oil-cut mud. No water was present. The zone is unidentified, but is is in a lime zone, above the Checkerboard.

Back from Ethiopia. Executives of Rogers Geophysical Company and members of the company's exploration crew in Ethiopia, gathered for a showing of movies of the crew's activities when they returned to Houston, Texas, recently. From watching the films of operations, the Rogers organization will develop new techniques and equipment for use in explorations in Ethiopia and other foreign countries. They are: Jesse R. Cornett, Russell Talty, Benny Walthall, John Monkhouse, Hank Gutormson, Glenn Fulbright, Ray Williams, Charles Hodde, and Oscar Lewis. Standing, Sam Rogers, president of Rogers Geophysical, and James B. Nichols.

Socony Tests Indicate New Oil Field Discovery

What appears to be a new oil field discovery, and indications of discovery in two additional wildcats, in Saskatchewan, Canada, has been announced by Socony-Vacuum Oil Co., Inc.

The wildcat that appears to open up a new field is Socony-Western Prairie Midway No. 1, in southwestern Saskatchewan, and about 15 miles southwest of the Fosterton field, discovered last January by Socony-Western Prairie. In a recent 90-min production test, the Midway well flowed 21 gravity crude at the rate of 288 bbl per day through a ⅜-in. choke, from a depth of 3450 ft.

One of the two additional wildcats is Socony-Western Prairie Cantuar six miles southeast of Fosterton. This well No. 10-14, recovered 1400 ft of 22.8 gravity clean oil on a drillstem test from 3231-54 ft from a Cretaceous sand. Another test from 3295-3305 recovered 1100 ft of clean oil from what is believed to be a Jurassic sand.

The other indication of discovery is in Socony-Central Leduc, Ratcliffe No. 1 in Southeastern Saskatchewan, four miles from the North Dakota-Montana boundary, and 65 miles northwest of Amerada's Beaver Lodge field in North Dakota. This well encountered oil shows through an interval from 6360 to 6450 ft, in limestone of Mississippian age. Oil gravity was 35 deg.

Offshore Well Planned

H. A. Hemphill, president, Texas Eastern Production Corporation, has announced that the company is preparing to begin drilling a new offshore well 20 miles southwest of Galveston and some seven and one-half miles off the coast of Galveston Island in the Gulf of Mexico. According to the announcement, the well, projected to a vertical depth of approximately 6000 ft, will be drilled as a directional hole to the southeast. Drilling contract has been awarded to the Salt Dome Production Company of Houston, Texas.

Sunray Gives Wyoming New Prolific Oil Field

A new oil field for the state of Wyoming was announced by Sunray Oil Corporation at its Dorothy Fox No. 3, in the Sage Creek Unit, Park County, Wyoming. The well has drilled into 9 ft of Tensleep oil producing formation and on drillstem test 3422-31 ft produced at the rate of 480 bbl per day of clean oil in a one-hour test. Bottom hole pressure is 1500 lb.

The new Sunray wildcat is two miles south of Wyoming's Frannie field, one of the state's best producing areas from the Tensleep formation. The Frannie field has already produced some 23,000,000 cumulative barrels of oil.

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Exploration

Louisiana Gets New Gas Discovery Well

Continental Oil Company has a new gas discovery in Bossier Parish, Louisiana, at its T. S. Goodwin No. 1. The new well, which was drilled to a total depth of 11,302 ft and plugged back to 7406 ft, flowed at an estimated rate of 600,000 cu ft of gas a day. Gas is coming from the Travis Peak formation through 5½-in. casing.

Sunray Makes Kansas Find

A wildcat discovery in Clark County, Kansas, 10 miles southeast of the town of Ashland just north of the Oklahoma boundary in the south central part of Kansas, has been completed by Sunray Oil Corporation. The well, Sunray's No. 1 J. C. Harper has tested 4,700,000 cu ft of gas per day on a 24/64-in. choke, with about 6 bbl of distillate to each 1,000,000 cu ft of gas.

The Harper No. 1 was drilled to 7350 ft in depth and production test was made through perforations at 5452-60 ft.

Mississippi Field Indicated

Ashland Oil and Refining Company and others are completing what appears to be a new discovery well in their No. 1 Winston Adams County, Mississippi. The test, a wildcat, is flowing natural after perforating casing in Wilcox pay at 5810 ft. Tests are being made.

Big Multiple-Pay Well Brought in in East Texas

A big multiple-pay gas-distillate discovery has been made in Hardin County, East Texas. Meredith, Clegg, and Hunt, et al, have completed their No. 1 Bruce Jackson for an open flow potential of 28,000,000 cu ft of gas daily and 53 bbl of 65 gravity distillate to 1,000,000 cu ft of gas. The rank wildcat has been completed at 8148 ft to 8204 ft in the Yegua sand, the lower section of what appears to be 6 productive sections.

New Nebraska Pool Seen

A new oil pool has been opened in Kimball County, Nebraska, at Gene Goff's No. 1 Long. Known as a new "D" sand discovery, the well completed for 11 bbl an hour on the swab for 6 hr at 6103 to 6111 ft and the crude tested 38.3 gravity. Full recovery from the Muddy was 2380 ft of light green oil.

Spraberry Producer Drilled

A good Spraberry producer has been reported by Cities Service Oil Company in northwestern Reagan County, Texas, in the completion of the company's TXL J No. 1 for a flowing potential of 406 bbl daily. Well is producing from the lower Spraberry sandstone, topped at 7444 ft.

Blackhawk Reports Oil Showings at Shallow Depth

Good gas showings at shallow depths have been reported by Blackhawk Oil Company in its Tulsa County, Oklahoma well, the No. 1 Joe Campbell. The well had indications of gas in the Big Lime formation, which has been topped at 275 ft, as well as in the Prue sand, at 350 ft, and the Oswego lime, at 510 ft. The well is drilling at 616 ft at the present time.

Kansas Gets Gas Discovery

Cities Service Oil Company (Delaware) has given Stafford County, Kansas, a gas discovery in its Florence E. Westgate No. 1 well. Operators reported a calculated open flow of 4,190,000 cu ft of sweet gas per day through perforations in the Basal Pennsylvanian sandstone from 4166 to 4184 ft and from 4190 to 4207 ft. Approximately 25 net feet of pay sand was recorded. The well is approximately 2½ miles west of the Farmington field.

Texaco Wildcat May Be New Well for Williston

The Texas Company has indications of a good producer in Rosebud County, Montana, at its No. 1 E. L. Grebe, wildcat well near Sumatra, Montana. Lower Amsden formation was hit at 4713 to 4783 ft, recovering gas in 24 min. The well is between the Sumatra and Ragged Point fields, and will possibly widen the eastern Montana boundaries of the 3-state Williston Basin field. It flowed oil after 42 min of a 50-min drillstem test. Recovery in addition to oil was 120 ft of drilling mud and 170 ft of water. Oil was dark brown 34.4 gravity.

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Exploration

Phillips Well May Have 100,000,000 Cu Ft Potential

Phillips Petroleum Company has a new gas discovery in which the tests of three sections of the pay zone have indicated that upon final completion the well will have a potential in excess of 100,000,000 cu ft per day. Discovery well is the No. 1 Glenna, Pecos County, West Texas.

At a total depth of 14,522 ft, the well had penetrated 917 ft into the Ellenburger Dolomite topped at 13,605 ft, with 598 ft of fractured Dolomite carrying gas from 13,924 ft to the total depth.

After setting casing to the depth of 14,485 ft, the bottom 37 ft of open hole had a potential of 9,000,000 cu ft per day natural and 60,000,000 after acidization. A test of a 60-ft section through casing perforations 14,400 ft to 14,460 ft showed a potential of 20,000,000 cu ft per day natural. A third test of a perforated section of 195 ft between 14,090 and 14,285 ft gave a potential of 16,000,000 cu ft per day natural.

The new deep discovery is located approximately 25 miles from the nearest previous Ellenburger producing pool.

Richfield Discovery Looms

Richfield Oil Corporation may have a new oil field southwest of Bakersfield, California, where its San Emidio 18-21 has produced 17 gravity crude oil at a 500-bbl a day rate. Flow is through a ½-in. bottom hole, during a 2-hr drill-stem test. A light, steady flow of gas accompanied the flow of oil during the formation test. Test was made in the Pliocene sand, between 7253 and 7280 ft. The well is about 11 miles west of Richfield's recent Wheeler Ridge pool discovery in Kern County.

Lion Wildcat Opens New Texas Oil Field

Lion Oil Company has opened a new oil field in Crockett County, Texas. The successful wildcat is known as the Shannon No. 1 but the field has not been officially named. The well, which was drilled to a total depth of 7709 ft, is flowing from the Ellenburger formation at the rate of about 240 bbl per day through a 16/64 in. choke. Gravity of the oil is 38.4 and GOR is 491-to-1.

Humble Well Flows 267 Bbl of Oil Daily

Humble Oil and Refining Company has completed its No. 1 State in Plaquemines Parish, Louisiana, to flow 267 bbl of 34.6 gravity oil daily. The well gaged 129.6 bbl of condensate daily along with 1,875,000 cu ft of gas from 7959 to 7961 ft. Gas-condensate ratio was 14,600 to 1. Tubing pressure was 2400 lb with gas-oil ratio 838 to 1. Oil flow was from 8495 to 8505 ft.

Georgia Test Staked

W. R. Miller and C. D. Neff, independent oil men of Dallas, Texas, have staked location for an 8000-ft wildcat in Seminole County, Georgia. Test is the No. 1 Robinson.

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Running Tour With Men in the Industry

▸ **J. F. Snyder,** Sinclair Oil and Gas Company's division land manager at Jackson, Mississippi, will transfer to Tulsa, Oklahoma, as assistant to H. B. Smith, executive vice president.

Other promotions include: **R. L. Sielaff,** division geologist at Denver, Colorado, to geological assistant to H. B. Smith, executive vice president at Tulsa, **C. D. Johnson,** district geologist at Albuquerque, New Mexico, to division geologist at Denver, **J. P. Moroney,** division landman from Denver, to Jackson, Mississippi, **C. W. Hortsmeier,** district landman at Oklahoma City to division landman at Denver.

M. H. Lowrance, district landman at Ardmore, Oklahoma, to district landman at Oklahoma City; and **J. E. Watson,** district landman at Shreveport, Louisiana, to district landman at Ardmore, Oklahoma.

▸ **Frank L. Fisher** has been promoted to regional geologist, exploration, and production department of Ashland Oil and Refining Company, and will be in charge of the company's geological work. **Wallace Hanson** has been named division geologist in the Midland, Texas, office and **John E. Thornton** has been district geologist at Wichita Falls.

James N. Brady, formerly at Ashland's St. Elmo refinery has been transferred to the Eastern division at Ashland, Kentucky, as scout for the geological and secondary recovery departments.

R. D. Gordon, Jr., formerly division geologist, has been named division manager at Oklahoma City. **A. G. Burki,** division engineer, has been promoted to division production superintendent.

N. F. Mefford, Ashland, petroleum engineer in the Henderson, Kentucky, division, has been promoted to assistant division production superintendent.

Al Sindel recently joined Ashland's Midland, Texas, office as division engineer and **W. H. Arrington, Jr.,** is a new petroleum engineer in Midland.

▸ **James D. Shipman,** petroleum engineering assistant, has been transferred from Magnolia Petroleum Company's Electra, Texas, producing district to the company's Pegasus district.

Martin D. Rowe, Jr., petroleum engineer, has been transferred from the Brownfield producing district to the Kansas division offices with headquarters at Wichita, Kansas.

Forrest D. Musson, draftsman for Magnolia in the petroleum engineering department offices at Wichita, Kansas, has been transferred to the producing department.

James G. L'therland, Jr., petroleum engineer, has been transferred by Magnolia from the West Texas division offices at Midland to the Dallas general offices where he has been assigned to the reserves and evaluation section in the petroleum engineering department.

John L. Sanders has been transferred from the drilling tools department at Port Arthur to the petroleum engineering department and stationed at Brownfield, Texas, as a petroleum engineer.

▸ **J. W. Hudson** has been named superintendent of drilling and **A. L. Rhodes** becomes superintendent of production in changes announced by Carl Houy, vice president, Deep Rock Oil Corporation.

Donald K. Auld, formerly chief engineer for the Eastern Kansas district, has been named superintendent replacing Rhodes. It was also announced that **James M. Moore,** former operations analyst, has been named office manager in the production division's Tulsa headquarters.

Rhodes, formerly superintendent for Deep Rock's Eastern Kansas production district at Garnett, will move to general headquarters in Tulsa, Oklahoma.

Hudson joined the company in 1951, as general superintendent of production. Rhodes has been with Deep Rock since May, 1951, when he was named superintendent in Eastern Kansas. Auld joined Deep Rock in 1949 as petroleum engineer in Eastern Kansas, and Moore became an employee through Deep Rock's purchase of another oil company.

▸ **Ish McKnight** has been named head of the land department for Parker Drilling Company in Tulsa, Oklahoma. He has been an independent oil operator, broker, and trader in Midland, Texas, for the last 6 years, moving to that city in 1936 as a scout for Mid-Continent. In 1943 he joined Lario Oil and Gas Company as a scout and landman, and the following year he joined Woodley Petroleum Company as a landman.

Golf Winners: At right are low net winners at New York Nomad golf party: E. F. Gahan, E. F. Gahan, Inc., Nomad runner-up; Harold Busold, Bill Foster Associates, guest winner; R. T. Meek, Ladish, Nomad winner, I. Frank Brown trophy; G. R. Weeks, Texaco, guest runner-up. Below: E. R. Smoley, Lummus, Nomad nearest pin; J. C. Merwin, Chain Belt, guest fewest putts; Henry McAdams, Gulf Oil, guest nearest pin.

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Visitors in New York. Attending the New York chapter of Nomads' spring golf party recently were six guests. They were: J. Boswell, J. Boswell and Company, Japan; C. T. Longcroft, Oil Well Supply, England; C. O. Isakson, Colombian Petroleum, Colombia; L. Daniels, Arabian American Oil Company, Saudi Arabia; J. S. Page, Page Oil Tools, Inc., California, and W. Seville, Texas Petroleum Company, Colombia.

▸ **R. M. Wemple,** former district production foreman of the Valley district, has been promoted to district superintendent and given supervision over the new Southeast Louisiana district of Pan American Production Company.

J. V. LeBlanc, former district production foreman of the Southeast Louisiana district of Pan American, has been promoted to district superintendent of that district.

Replacing Wemple is **R. M. Decker,** former production foreman in the Southeast Texas district. **C. W. Daniel,** formerly head roustabout at Olive field, has been promoted to production foreman, replacing Decker in the Southeast Texas district.

J. H. Todd, formerly chief operator of the Willamar pressure maintenance plant in the Valley district has been promoted to pressure maintenance plant foreman. Todd has been replaced by **William Steward,** former auto mechanic, as chief operator of the maintenance plant.

Sectionalization changes in the exploration department of Pan American Production Company have resulted in the formation of a geophysical section supervised by **O. T. Lawhorn,** section head, and a drafting section supervised by **W. O. Shands,** section head.

Lawhorn was formerly chief geophysicist of the exploration department. Shands was formerly chief draftsman of the geological drafting section of the civil engineering department, which has been transferred to the exploration department under **Ben H. Martin,** department superintendent.

▸ **James Palacas,** Harvard University graduate, has been named to Geological Well Service Company's overseas field geological trainee staff, it has been announced by Dan Kralis and J. C. Stamm, co-owners. Other appointees are: **Ellsworth Vachon,** Washington University graduate, **Robert Harpster,** Beloit University graduate, **Alfred Dimon,** Montana School of Mines graduate, and **Kenneth Thornton,** Texas University graduate.

▸ **John A. Murphy,** chief reservoir engineer for Continental Oil Company, has moved his headquarters from Ponca City, Oklahoma, to Houston, Texas. Murphy joined Continental four years ago at Ponca City as a reservoir engineer, after serving in similar capacities with other oil companies in California and Texas. He was promoted to supervising engineer in 1949 and became chief reservoir engineer in 1950. He is a University of California graduate.

Announced at the same time were promotion of three other engineers in Continental's reservoir engineering section. They are **W. W. Wilson,** who became assistant chief reservoir engineer; and **J. R. Spencer** and **W. A. Mead,** both of whom were promoted to supervising reservoir engineers. All three will continue headquarters at Ponca City.

Vance Sibley

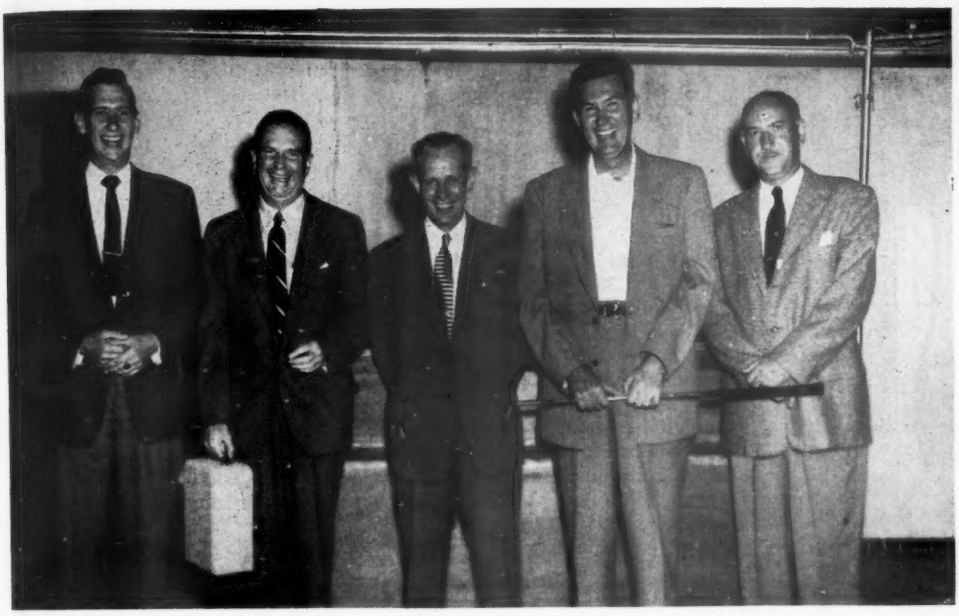
E. H. Wilkins

▸ **E. H. "Doc" Wilkins** has been named vice president of Vance Sibley and Company, oil well servicing concern with headquarters in Levelland, Texas, it has been announced by Vance Sibley, president. It was also announced that a new company, Sibley & Wilkins, Inc., drilling services, has been formed with Sibley as president and Wilkins as vice president.

Before forming Vance Sibley and Company, Sibley was district superintendent for Stanolind Oil and Gas Company for the Odessa and Levelland districts.

Wilkins had been with The Western Company since 1942 and was successively treating engineer, station manager, and district manager for that company at Levelland.

Low gross winners at New York Nomad golf party are, right: J. W. Chanda, A. O. Smith, Nomad runner-up; John Evans, Lucey Export, Nomad winner; Ashley Moore, Socony Vacuum, guest winner, and H. T. Leonard, Culbert Pipe and Fitting, guest runner-up.



Guest tying for high gross winner was William Van Order, National Supply; Oliver Maggard, Clyde Iron Works, Nomad longest drive; Andy Carney, Corporacion de Fomento de la Produccion, guest high gross, tie; J. J. Johnston, Aramco, guest longest drive, Norris Boulden, International General Electric, Nomad high gross.

▸ **Glen Harsh,** formerly Cities Service Oil Company assistant division superintendent for North Texas and South Oklahoma, has been transferred to the Bartlesville headquarters offices as assistant general superintendent.

Replacing Harsh at Oklahoma City as assistant division superintendent for North Texas and South Oklahoma is **Hugh L. Riley** of Graham, Texas, formerly district superintendent there.

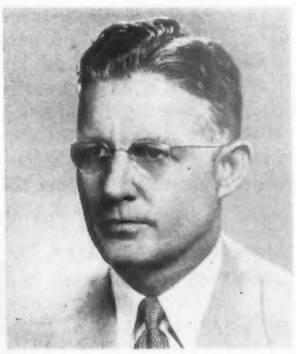
F. D. Priebe of Odessa, Texas, has been elevated to district superintendent at Odessa, Texas, replacing **C. R. Smith,** who was transferred to Bartlesville recently as general superintendent of production. Stepping into Priebe's former position as district engineer is **Donald L. Kastner** of Russell, Kansas. William C. Newlin is being transferred from Oil Hill, Kansas, to Russell to replace Kastner as district petroleum engineer.

A. E. Straub of Bartlesville has been appointed assistant chief production engineer to enable **J. R. Hatfield,** chief production engineer, to devote his entire time to increasing technical problems incident to the company's expanded production program. **L. B. Hicks** of Bartlesville has been named equipment engineer and will assist **J. L. Bole** in handling drilling contracts.

With an intensive test-well drilling program in the Rocky Mountain area, several transfers have been made to strategic operations points in that area. **C. D. Zlomke** of Gladewater, Texas, assistant production foreman, has been transferred to Rock Springs, Wyoming, to supervise the company's production activities there. **Donald F. Presley** of Gladewater has stepped into Zlomke's former position and **Eugene F. Motter** of Madison, Kansas, has been transferred to Gladewater as production engineer. **O. C. Atkinson** of Graham, Texas, special engineer, has been moved to Vernal, Utah, and **G. L. Goodwin** of Lindsay, Oklahoma, assistant production foreman, has been transferred to Lima, Montana.

Haden J. Upchurch

James W. Burkhart



Robert E. Daniel

▸ **Robert E. Daniel** has been named secretary and treasurer; **James W. Burkhart,** production manager; and **Haden J. Upchurch,** manager, land department, of Texas Eastern Production Corporation.

Daniel, formerly assistant controller of Schlumberger Well Surveying Corporation, Houston, is a graduate of the Personnel Administration Course at the Texas A & M Summer College.

Burkhart, former general superintendent of Brown and Wheeler, oil operators, attended college at Texas Tech and Oklahoma University and received a degree in petroleum engineering from the latter.

Upchurch, former district landman for the Cabot Carbon Company, Midland, Texas, is a native of Tyler, Texas. He studied law at the University of Texas School of Law.

Running Tour

J. B. Newland has recently joined the firm of Trafford and Associates as a senior geologist, and **K. R. Stout,** exploitation engineer, has been made a junior associate.

Newland received his B.A. in geology from University of Iowa in 1929. He joined the Cities Service and spent a number of years as sub-surface geologist in the Permian Basin in West Texas and New Mexico. In 1945 he joined Imperial Oil Limited at Calgary, remaining with Imperial until joining Trafford and Associates. Stout, who graduated from the University of Birmingham, England, in 1945 with first class honors in petroleum engineering and refining, began his oil field training with D'Arcy Exploration and after graduation joined the Shell Oil Group.

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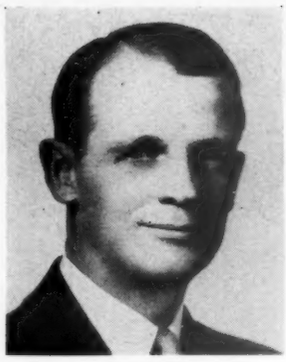


H. W. Ross

H. W. Ross, petroleum consultant, is opening new offices at Calgary, Canada, at 809 Avenue W. He was formerly assistant secretary and manager of the Sohio Petroleum Company. In 1925 he joined The Texas Company and was with that company for 12 years as manager of its Eastern U. S. drilling and production operations. In 1939 he joined Dow Chemical Company in its oil and gas well chemical division and spent several years covering the majority of the major oil fields of the U. S., Canada, and Mexico.

In 1948 he joined Standard Oil of Ohio, acting as assistant to the vice president of Sohio Petroleum. In March of 1949 he began making periodic trips to the Western Canadian area surveying for Sohio. He left Sohio July 1 to set up his own business.

E. J. Hamner, has been named area manager of the California area of Humble Oil and Refining Company. Other appointments in a revision of the California area of the organization include: **H. W. Hankinson,** area landman; **H. J. Baumann,** assistant area landman; **J. B. Hudson,** area geophysicist; **E. H. Bescher, Jr.,** area chief scout; **S. J. Barclay,** area petroleum engineer; **H. B. Barton,** assistant area petroleum engineer; **W. A. Castille,** area civil engineer; **H. O. Pattison,** assistant area civil engineer; **T. M. Roper,** area division chief clerk; **John A. Porter,** assistant area division chief clerk.

In the Castaic junction district, **J. E. Cox** has been named superintendent; **T. L. Epps,** chief clerk; **J. B. Bower,** farm boss. For Bakersfield district, the company named **J. M. Sheppard,** superintendent; **Francis Pendarvis,** district petroleum engineer; **O. A. Scott,** chief clerk; **D. M. Griffiths,** district civil engineer; **J. V. Walvoord,** farm boss, and **Grant A. Daugherty,** farm boss.

Temporary training assignments recently announced by Humble for its production department resulted in additional personnel changes.

W. J. Barrett, assistant division superintendent of Southwest Texas, returned to his regular position as district superintendent of Government wells district.

John J. Carter, gas contract supervisor and analyst, was named assistant superintendent of the gas division while **R. J. Schilthuis** is on a training assignment.

W. T. Dabbs, who has been acting division superintendent in West Texas division, returned to his position of district superintendent at Snyder.

J. E. Byars, toolpusher, relieved **D. C. Rhodes** as acting superintendent in charge of operations in the Galveston bay district, Gulf Coast division, while Rhodes is on a training assignment as assistant division superintendent in the Gulf Coast division office.

Bert E. Crowder, supervising petroleum engineer, was promoted to assistant district superintendent of the London district, replacing **J. M. Sheppherd** promoted to district superintendent in the Bakersfield district, California area.

Stanley J. Lewis, assistant division civil engineer, East Texas division, transferred to the Louisiana division as assistant division civil engineer, replacing **W. A. Castille,** who was named division civil engineer of the California area.

George W. Dabney, Jr., toolpusher, West Texas division, was transferred to the Bakersfield district, California, as toolpusher.

Everett C. Clark, Jr., district civil engineer, Sugar Valley district, transferred to the Southwest Texas division office as supervising civil engineer.

C. R. McKinnon, party chief, Gulf Coast division, returned from military leave May 1.

In the company's Gulf Coast division, **W. D. Stovall,** at Sugar Valley, **Paul Eddy** at Anahuac, and **C. H. Heintschel** at Conroe were each promoted to farm boss; and in the same division, **Thomas Craig** at Sugar Valley, **D. C. Mott** at Raccoon Bend; **H. R. Preston** at Friendswood, **J. M. Jordan** at Conroe, **J. V. Silva** at Anahuac, **O. L. Moore** at Galveston Bay, and **O. T. Evans** at Lovell Lake were all named gangpushers.

W. C. Carmack at Sugar Valley and **T. L. Reaves** at Hardin were promoted to assistant district chief clerks.

Allen P. Bowie has been granted leave of absence from the General Petroleum Corporation, and is currently serving as chief of petroleum reserves for Petroleum Administration for Defense.

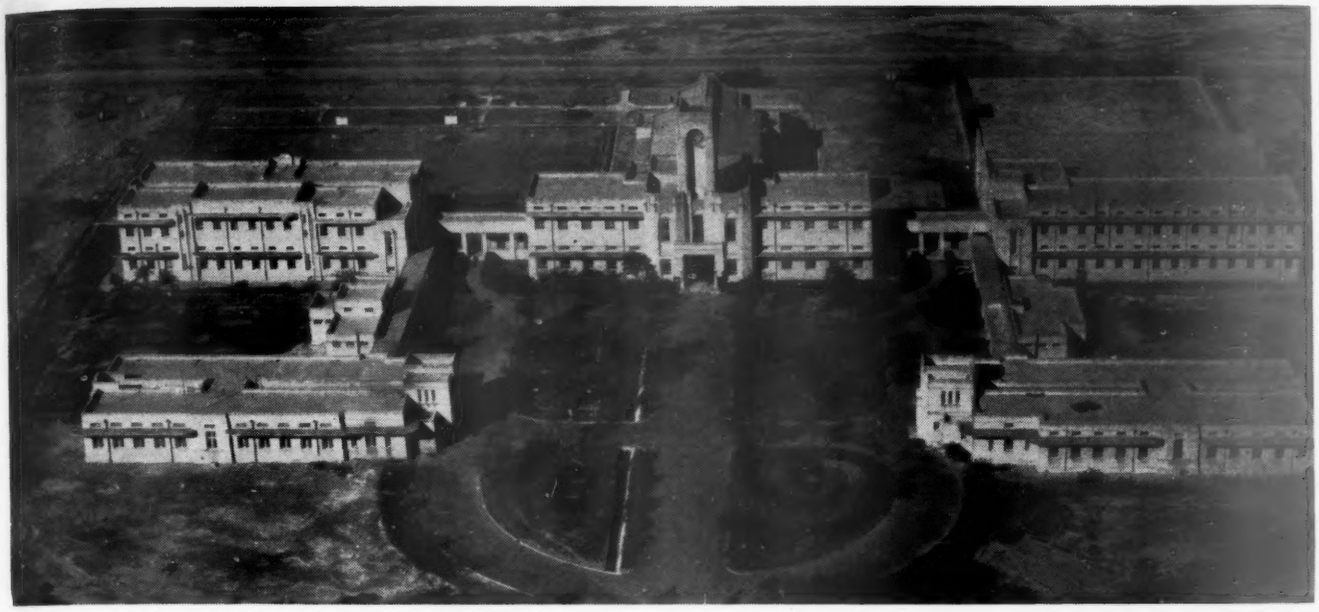
Prior to taking over his government duties early in June, Bowie was district petroleum engineer in the company's exploration division offices at Ventura, California. **Innes M. MacKenzie, Jr.,** has been transferred from the Los Angeles office to succeed Bowie.

A graduate of the University of California in 1932, Bowie joined General Petroleum's exploration department in 1944. MacKenzie, who has been with the exploration department since 1945, held the position of petroleum engineer.

Due to the expansion of General Petroleum activities in the San Ardo area, two employees were transferred there.

C. V. Dittman, now superintendent of the Salinas Valley district, will have charge of all production department activities in that area. He was formerly drilling superintendent, San Joaquin division, production department.

N. W. Schultz, petroleum engineer, will be responsible for petroleum engineering activities there. He was transferred from exploration department offices in Bakersfield.



Courtesy of Anglo-Iranian Oil Company.

The Technical Institute, Abadan, Iran.

Communications—Life Blood of Operations

Better understanding between management and engineers is difficult to obtain but essential to well run businesses

ARCH L. FOSTER*

SOMEWHERE in the Good Book is an admonition to avoid permitting the right hand to know what the left hand is doing. Very definitely that is not the trend in the policy of industrial companies employing engineering, technical, and scientific personnel. In fact, one of the major activities among top-ranking policy-determining executives and their staffs is that of improving the intercommunication system and its efficiency between management and scientifically trained personnel in all fields, personnel which here will be termed collectively, "engineers".

One of the main causes for dissatisfaction between engineers and executive groups, or in general, management is and has been that of transmission of information of all sorts from one group to the other and vice versa. In an earlier day, when management was represented by the owner of the business—when the owner *was* the management — the engineer was represented by two or three men trained by long experience as apprentices until they became known, finally, as journeymen of their trades, and the exchange of information, plans, policies, and the wishes of management as well as the worries and disgruntlements of the "engineers" was quick, direct, and essentially complete. The "boss" knew everybody, who also knew the "boss".

Not true as of recent times. And with our greatly awakened consciousness of the human side of our entire national and international life, present-day management is making pointed efforts, in varying degrees, to improve company efficiency by revising policies with regard to communications between these two divisions, found in every company employing engineers.

Early this year the National Society of Professional Engineers made a survey of this field, and came up with some interesting disclosures about the state of affairs in this wise. Increasing size of staffs and of companies has broken down older methods of transmitting information intra-company. From more than 300 industrial concerns in more than 100 different fields wide differences of policy were brought out. One executive wails that it is desirable to see *all* the staff but time will not permit. Another lays the responsibility for keeping engineers informed of management's wishes on the shoulders of supervisory groups in the company.

The general picture disclosed by the investigations boils down to two facts, management wants to have the opinions of engineers and wants them to know what management expects of them. Engineers want to know the expectations of management, to know what is expected of them, and want to know where management wants to go with their plans. In short engineers want to be "in the know" on company objectives, plans, policies, demands on the engineering staff. How to accomplish all this is the continuous "fly in the ointment".

One of the main criteria in determining the position of the engineering staff in company management is their participation in company planning, it appears. Study of replies from companies show that from project engineer upwards in rank a greater and greater part is taken in company planning. The chief engineer is an important man, sometimes he has a greater part in planning than has the vice president in charge of engineering. On purely engineering matters he is credited with 36 per cent participation in planning to the vice presi-

*Editor, Refining and Gas Processing.

EXCLUSIVE

TABLE 1. Engineers in management planning.

Engineers Who Participate in Planning	Strictly engineering matters Per cent	Corporate organization Per cent	Finance Per cent	New products and processes Per cent	Employee training Per cent	Purchasing Per cent	Plans for expansion Per cent
Vice president in charge	21	66	59	25	24	27	33
Chief engineer	36	29	31	38	41	38	40
Project engineer	25	3	6	23	19	22	15
Engineering staff	18	2	4	14	16	13	12

dent's 21 per cent. On new products, expansion plans, employee training, and on purchasing the chief engineer outranks the vice president as much as 41 to 24 per cent participation, or as much as 70 per cent greater participation in those phases of management. The vice presidents have the greater weight in finance and corporate organization planning, however. (See accompanying table).

Management is trying to get the ideas, suggestions, and advices of its engineers. Also management is somewhat dissatisfied with the results to date, and almost half of those reporting blame the general principle of "communication" for the poor showing. Eighty-eight per cent of the companies report they ask for opinions and suggestions of their engineering staffs on general management matters. Those companies who do not are small outfits with few engineers. Among those asked about their opinions on management matters the chief engineer again tops the vice president in charge of engineering, on subjects including sales promotion and customer services.

Suggestions for improving "communication" within the ranks include the idea of holding more conferences and of recognizing the general knowledge and opinions of their engineers, rather than solely their engineering capabilities. More interviews between engineers and management "at the project level", will help also, others believe. Letting the engineers, including those in the lower ranks, know about plans, goals, policies early in the life of a project, for example, appears to be the gist of ideas for improving liaison between these groups. Engineers can help by improving their outlook on sales problems, labor matters, and the economics of their industry. Conveying suggestions between divisions is mentioned as another way to better relations.

As may be expected, it was found that the subject about which the engineers wish to know more of management's ideas is that of individual advancement prospects, followed closely by the number who want to know about new processes and products considered by management, and company plans for expansion.

Outstandingly enough, the "benefits and security" factors of employment, that rate so very high in the minds of non-technical labor in general, are of lesser interest to the engineer than to any other industry group on which information has been collected, which further indicates the individualistic attitude of the traditional engineer. The great majority has always preferred to "go it alone".

In agreement with the apparently general trend toward putting engineers into managerial and executive positions, more than 90 per cent of the companies reported that they consider trained engineers as potential candidates for management executive positions. Those not taking this attitude are small companies in lines in which engineering is not important. The number of executive engineers in the various companies ranged from about 50 per cent in one-third of those firms reporting, up to 100 per cent in a large group—15 per cent—of those surveyed, or presumably about 50 companies.

Strangely enough, more than half of the companies say they have no special introductory training or indoctrination routines for new employees. Those who do have special training programs utilize this period to outline the opportunities for the employee, and for management communications activities.

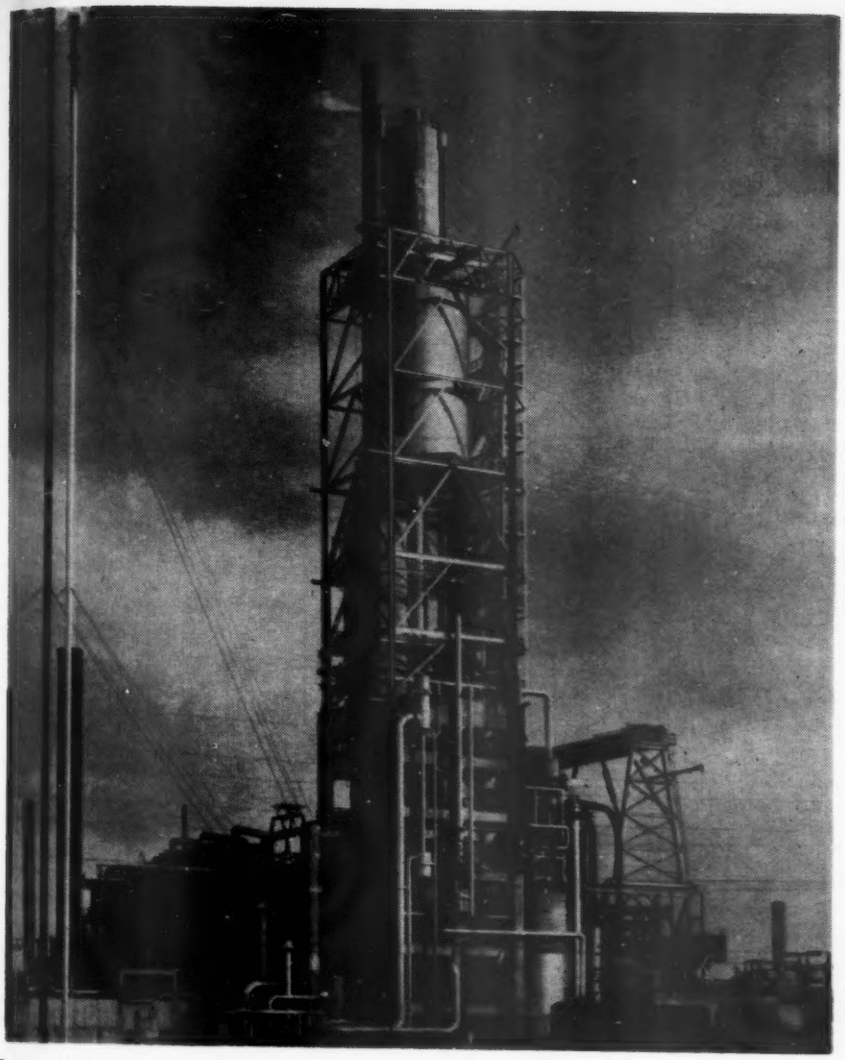
Many leaders believe that face-to-face communications are the best available means for liaison between management and technical staffs, as shown by Socony's G. S. Dunham (API, May, 1952). In this instance "up-and-down" directions for communications are provided by holding an annual meeting of the manufacturing committee, at which meeting each manager presents the capital requirements for his operations, covering a period of three years. All details of the past year's operations in each phase of each plant's work are presented. Meetings are small enough to serve as working conferences, where each man makes contact with the whole committee. Auxiliary meetings of smaller groups take up current operations, industrial relations, and other pertinent problems, especially employee relations matters, in which employee representatives are included.

"Sideways" communications include visits and conferences with plant personnel by, for example, the patent department, in each plant. Annual manufacturing group meetings are held, to discuss all problems and activities. Laboratory process development men, and engineering division representatives visit each plant, discuss individual problems and programs with the local staffs, and give help when possible. Annual meetings of specialists are held to give training in separate lines of work and to discuss their specialties with individual refinery groups. In all these activities the face-to-face method of communication is utilized as far as at all possible.

One of the major principles to employ to obtain cooperation from and understanding by employees is to present to them all matters in terms of their own self-interest, rather than in showing the advantages of a given procedure or operation of the company or to "top brass" (Naden and Kolb, API, May, 1952). Seven means may be employed, for example, to communicate effectively between management and engineer-employees. These are: Top leaders as inspirational agents; obtaining opinions of employees; developing an "atmosphere" that promotes communication; getting the company story over; emphasis in the labor-relations field; education in economics, and general political and social indoctrination. One or more of these means may be employed by management in arriving at the desired condition of affairs. Mutual respect between the contacting groups is indispensable to real effective communication. Management and the employee, engineer, or other category, must meet on the same level. Management must not "talk down" to an employee, must deal with individuals and recognize individuality of each engineer or other employee, not deal as with a "mass" of personnel, impersonally.

Especially important is the matter of communication between the research staff and management, it appears. The researcher by nature and training is an individualist. Having attained a high level of academic or scholastic training, the PhD level, he may react against communication plans and policies, when first coming into a refining organization, Sohio's E. C. Hughes points out (ACS, Cleveland, 1951). Researchers are "allergic" to written reports, but the topical report, giving results attained, is more to the liking of the research engineer-scientist than progress reports, which have been abandoned in many cases. Much of the problem is solved by the supervisory staff who must promote satisfaction between the highly specialized researcher and his employer by close and frequent communications. Communication is improved by a training course, can reach its goal only by day-to-day use. Management, the Big Boss, must take part in this training. Supervisor's and management's ideas must be communicated to the staff frequently. Upward communication must show the same facility as communication downward from management to employee. Philosophies, policies must be repeated frequently to have maximum effectiveness. Periodic conferences are desirable where face-to-face communication is carried out. Working plans are to be reported at frequent intervals, so that "When he (the researcher) arrives at the solution of a problem, the shock of the new idea will not be experienced by management". These working plans are needed by the researcher, Hughes says, to sharpen his attack on his problem, and to consider the adequacy of his work. Thus they enlist his cooperation, and they invite thoughtful suggestions all along the line.

Although the items and ideas presented herein are sketchy and barely scratch the surface of this increasingly important field, they may serve as arrows to show the direction of progress in the all-important problem of management-engineer intercommunications. ★



Trenton, Michigan, 15,000 bbl a day TCC airlift installation.

Catalytic Cracking in Airlift TCC Units

Five schemes show how process can be applied to most refining processing situations

W. W. HAMILTON†, S. C. EASTWOOD†
A. E. POTAS†, E. A. SCHRAISHUHN†

THE petroleum industry has witnessed a remarkable expansion in the use of the Airlift TCC catalytic cracking process during the past year. Not only are many domestic refineries large and small adding TCC capacity, but the process is also making its appearance on a wide scale in refineries abroad. This growth in popularity is due to the marked improvement in the process embodied in the Airlift TCC unit. It is the purpose of this paper to review briefly how the new unit compares with its predecessor, the bucket-elevator type unit, and to illustrate the range of stocks to which the improved process is being applied, with typical data on product yields and quality. The design features of the Socony Airlift TCC unit have been described in previous publications.[1,2,3,4]

†Socony-Vacuum Laboratories, Research and Development Department, Paulsboro, N. J.

Salient Features of the Airlift Unit

The new Airlift TCC unit offers many improvements over the bucket-elevator type unit while retaining all the important advantages associated with the older unit; e.g., high liquid recovery, high cracking efficiency, high equilibrium catalyst activity, and high ratios of gasoline to gas and to coke. A simplified diagram of the new unit is shown in Fig. 1.

The new unit differs from its predecessor in three major respects. One, the Airlift TCC unit, as the name implies, employs a pneumatic lift to elevate the catalyst to the top of the unit. The design of the lift is based on several years development work, including the operation of a full-scale experimental lift. The commercial Airlift TCC units now in operation are showing low catalyst attrition rates in line with those predicted from the experimental lift. The operating units are showing bead catalyst make-up requirements ranging from 0.2 to 0.4 lb per barrel of charge.

Two, the reactor has been superimposed above the kiln; therefore, the catalyst is elevated only once for each complete cycle through the unit. With this design there is only one catalyst level in the system that must be controlled. These features contribute greatly to the operating simplicity of the new unit.

Three, the catalyst circulation rate has been increased to permit a major simplification of the kiln by elimination of multiple-stage regeneration with all of its attendant internal equipment. The new kiln employs split-flow of the regeneration air and has only one set of cooling coils.

The higher catalyst-to-oil ratio also permits operation at higher conversion levels. At the same time, it should be noted that the catalyst-to-oil ratio is kept as low as possible consistant with the foregoing requirements, as further increases in catalyst circulation cause the undesirable results of more catalyst attrition, higher utility and investment requirements, higher coke production and lower liquid recovery without providing compensating advantages.

Reactor and Kiln Capacities

Airlift TCC units have been fully engineered which have reactor charge capacities ranging from 1500 to 25,000 bbl per day. Kiln carbon-burning capac-

Airlift Units Now In Operation

The first Airlift TCC unit was put on stream in October, 1950, at the Beaumont, Texas, refinery of Magnolia Petroleum Company. By early 1952 thirteen additional units had been placed on stream and construction has begun or been authorized for 21 additional units. The total cracking capacity of these 35 Airlift TCC units, now in operation or approved to date, amounts to over 400,000 bbl per day. This new-type TCC unit was developed and is licensed solely by Socony-Vacuum Oil Company, Inc.

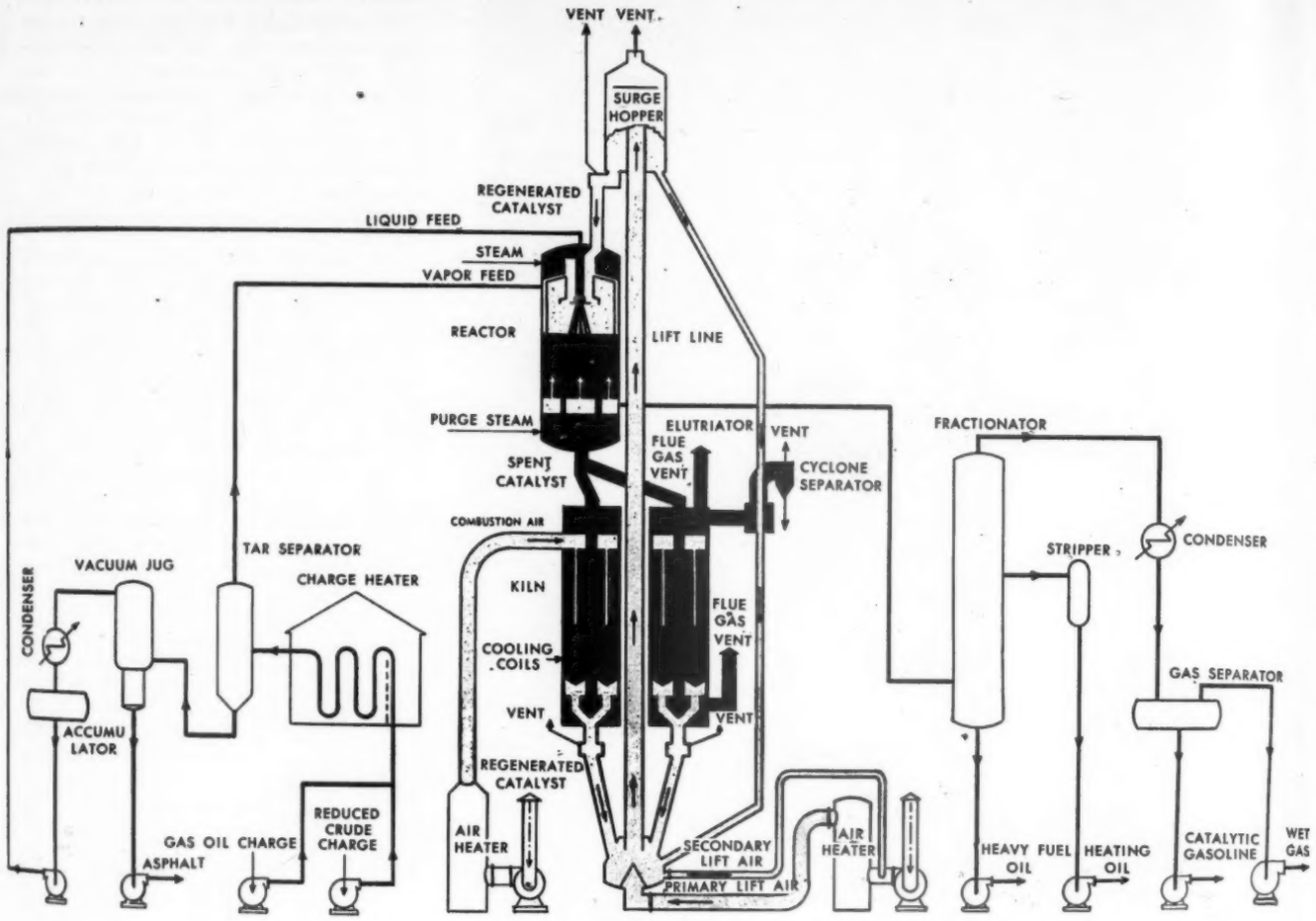


FIG. 1. AIRLIFT TCC CATALYTIC CRACKING PROCESS.

ities range from 1100 to 12,500 lb per hour. A unit of essentially any other capacity can be designed for a specific installation if one of the units already engineered is not of proper size. Units in the smaller sizes, namely 1500 bbl per day to 6000 bbl per day capacity, are available as "package" or prefabricated units. The "package-type" TCC unit makes catalytic cracking available to the small refinery with an investment cost per barrel in line with that for the larger units.

Operating Variables

Although each TCC unit is generally designed to charge a specific feed stock and to produce specific products, any given unit has considerable flexibility with respect to both. This flexibility is obtained by changes in one or more of the operating variables. The major TCC process variables and the usual range through which each can be varied is as follows:

1. Space velocity—1.0 to 3.0 volumes of oil per hour per volume of catalyst in the reactor (V/Hr/V)
2. Catalyst to oil ratio—2.0 to 6.0 volumes of catalyst per hour per volume of oil per hour (V/V)
3. Reactor average temperature—850 to 925 F
4 Catalyst activity—25 to 32 CAT-A index
5. Recycle to fresh feed ratio—0 to 1.5 volumes of recycle per hour per volume of fresh feed.

Certain combinations of the above variables can be selected to give large changes in product yields from a given stock, or to accommodate variations in charge stocks. Naturally, it is not commercially practical to design all combinations of all process variables in a given unit. The variables most commonly adjusted in commercial operations are average reactor temperature, a function of oil and catalyst inlet temperatures and catalyst-to-oil ratio; space velocity, a function of bed depth, and catalyst-to-oil ratio, a function of catalyst circulation rate.

Both bead synthetic and clay natural catalysts are used in Airlift TCC units. This paper discusses operations on bead catalyst, which is more generally used.

Typical TCC Stocks

Airlift TCC units are being designed to process gas oils from a large variety of crudes. Although the charge stock from a given crude may vary in boiling range from a very light to very heavy gas oil, the most common cut available for catalytic cracking is the gas oil fraction between kerosine or light fuel oil and asphalt. Properties of typical TCC charge stocks from six of the more common crudes are shown in Table 1. These

TABLE 1. Properties of TCC charge stocks.

Stock	Mid-Continent wide cut gas oil	Mid-Continent heavy gas oil	Mirando wide cut gas oil	Scurry County wide cut gas oil	Slaughter West Texas gas oil	Tibu-Petrolea (Colombia) wide cut gas oil	Iranian mixture wide cut gas oil
Cut on crude, per cent vol...	44.5–89.5	59.7–89.5	4.5–94.8	62.4–92.8	34.0–83.0	37.0–80.0	30.8–80.9
Properties							
Gravity, API.....	29.6	26.8	21.4	28.5	26.2	30.7	30.5
Bromine number.....	7.0	7.4	7.5	12.0	12.3	5.6	10.4
Aniline point.....	178	187	132	183	156	191	168
Pour point, F.....	85	90	<—30	90	80	85	75
Sulfur, per cent weight....	0.41	0.58	0.17	0.37	2.34	0.75	1.28
Conradson carbon, % wt...	0.13	0.23	0.12	0.20	0.28	0.29	0.08
Viscosity, KV @ 100 F...	15.9	38.1	14.8	19.5	13.8	15.1	.....
Viscosity, KV @ 210 F...	3.35	5.52	.....	3.71	3.08	3.30	.....
Distillation, vacuum assay, F IBP.....	478	600	400	450	525	444	450
10 per cent volume...	568	640	482	580	572	555	508
50 per cent volume...	712	790	603	750	698	734	661
90 per cent volume...	912	990	853	920	948	931	898
95 per cent volume...	950	1010	890	960	980	962	932

include wide-cut gas oils (above kerosine) from Mid-Continent, Mirando, Scurry County, Slaughter, Colombia, and Iranian mixed crudes. Properties for a heavier gas oil (above light fuel oil) from Mid-Continent crude are also included.

The charge stock for TCC units may be prepared by any conventional method, such as, distillation, solvent deasphalting, or coking. A method commonly used for TCC installations (and which is most economical in many cases) is to preheat the reduced crude from the straight run unit to about 825 F and flash it in a tar separator (see Fig. 1). The tar separator overhead goes directly to the TCC reactor as vapor feed. The tar separator bottoms are flashed without additional heat in a vacuum flash unit, and the overhead vapor is condensed, reheated and injected into the TCC reactor as liquid feed. An alternate method, of course, is to charge the entire reduced crude to a vacuum unit, but this method requires condensation and reheating of the entire TCC feed as compared to condesing and reheating only a part of the feed in the first scheme. Other types of feed preparation systems can employ visbreaking or coking. The TCC unit also provides flexibility by permitting the charging of whole crude to the tar separator whereby the straight run gasoline is processed through the TCC reactor along with the gas oil.

TCC Yields

Typical yields that can be obtained by once-through cracking of the charge stocks described above are shown in Table 2. All of the yields are for concurrent flow over equilibrium 31 activity index bead catalyst at 4.7 catalyst-to-oil ratio, about 880 F average reactor temperature and at a constant carbon yield. The only process variable that was adjusted to compensate for the different coke-forming characteristics of the various stocks was space velocity.

The once-through yield of 10 RVP motor gasoline for this type of operation ranges from 46.0 per cent volume for Mirando gas oil to 37.1 per cent volume for Slaughter gas oil. Processing the gas oil above light fuel oil, as compared with the gas oil above kerosine, from Mid-Continent crude produces about 1.4 per cent volume lower yield of 10 RVP motor gasoline at the same carbon yield. The yield of gasoline from all stocks except Mirando can be increased by about 8 per cent volume by alkylation of the available butylenes* or about 5 per cent volume by catalytic polymerization of the butylenes and propylene† from the TCC operation. The Mirando gas oil produces a lower yield of unsaturated light hydrocarbons, which results in a lower yield of alkylate (3.7 per cent volume) or catalytic polymer (3.9 per cent volume).

*C_4-free motor alkylate yield, per cent volume, is calculated as 172 per cent of the available $C_4=$ by volume.

†10 RVP catalytic polymer yield, per cent volume, is calculated as the sum of 70 per cent of the $C_4=$ by volume and 50 per cent of the $C_3=$ by volume.

Product Properties

The properties of the TCC products vary to some extent with the properties of the TCC charge and the severity of the cracking operation. A summary of the properties of the cracked products from TCC processing the gas oils described above is shown in Table 3.

TCC gasoline is well known to have excellent quality so that treating of the gasoline is no particular problem. Normal refinery gasoline treating procedures; i.e., caustic treating and water washing, followed by a short interval of storage, will produce a doctor sweet gasoline from all the charge stocks listed, including the high-sulfur Slaughter gas oil. If inhibitor is used the quantity added is in the range of only 2 to 3 pounds per 1000 bbl. Sulfur contents of the TCC gasoline are usually about 6 to 8 per cent of the sulfur content of the charge stock. The octane ratings of the 10 RVP TCC gasolines range from 90.5 to 96.2 F-1 unleaded and from 96.5 to iso. + .05 cc TEL F-1 with 3 cc TEL. The addition of alkylate or catalytic polymer to the TCC gasoline increases the leaded F-1 octane number by 0.8 and 0.4 respectively.

The TCC distillate fuel oil, above a 385 F at 90 per cent motor gasoline and having a 595 F at 90 per cent goes into No. 2 fuel oil, and it is known that relatively high percentages of TCC distillate fuel oil can be blended into saleable No. 2 fuel oil. Addition of minor percentages of kerosine is sometimes necessary to meet volatility specifications for No. 2 fuel oil. This TCC distillate fuel oil has a pour point of about –25 F for naphthenic stocks and a pour point in the range of 10 to 15 F for paraffinic stocks. Cetane numbers for these base stocks vary from about 50 for the Mid-Continent wide-cut gas oil to 25 for the Mirando gas oil. TCC processing stocks free of No. 2 fuel oil produce distillate fuel oils with cetane numbers lower than those obtained from wide-cut gas oils. For example, the No. 2 fuel oil from a Mid-Continent heavy gas oil has a cetane number 17 points lower than the fuel oil from a wide-cut gas oil. The sulfur content of the TCC light fuel oil is generally about 85 per cent of the sulfur content of the charge stock.

The heavy catalytic fuel oil produced from TCC cracking provides a satisfactory cutter stock for blending with heavy tars to produce residual fuel oils. The sulfur content of the heavy fuels is about 150 per cent of the sulfur content of the charge stock.

Effect of Carbon-Burning Capacity on Yields

The effect of increasing carbon-burning capacity in TCC operations on product yields is shown in Table 4. As pre-

TABLE 2. Typical TCC yields from various charge stocks. Type of Operation—once-through — catalyst — 31 AI beads.

Charge stock	Mid-continent wide-cut gas oil	Mid-continent heavy gas oil	Mirando wide cut gas oil	Scurry County wide cut gas oil	Slaughter West Texas gas oil	Tibu-Petrolea wide cut gas oil	Iranian mixture wide cut gas oil
Cut on crude, per cent volume	44.5-89.5	59.7-89.5	4.5-94.8	62.4-92.8	34.0-83.0	37.0-80.0	30.8-80.9
Operating conditions							
Oil inlet temp., F	810	810	810	810	810	810	810
Catalyst inlet temp., F	1035	1050	1035	1040	1035	1035	1030
Average reactor temp., F	885	885	880	870	880	885	880
Space velocity, total feed, V/Hr/V	1.3	2.0	1.5	1.5	1.6	1.4	1.15
Catalyst to total feed ratio, volume	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Steam, per cent weight total feed	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Pressure, psig	10	10	10	10	10	10	10
Conversion, per cent volume	55.5	51.6	55.5	55.9	49.9	50.1	52.3
Yields on fresh feed							
Heavy fuel oil, per cent volume	18.1	30.9	6.6	18.7	18.3	17.0	9.7
Light fuel oil, volume	26.4	17.5	37.9	25.4	31.8	23.9	38.0
C_4 free motor gasoline, 385 @ 90 per cent, volume	40.5	38.8	43.0	40.8	35.2	41.9	37.2
Total C4's, volume	14.3	12.5	13.5	14.4	13.6	16.7	13.2
Dry gas, per cent weight	6.8	6.0	6.3	6.3	6.9	7.3	6.7
Coke, weight	3.9	3.8	3.7	3.9	3.8	3.9	3.9
C_3 free liquid recovery, per cent vol	99.3	99.7	101.0	99.3	98.9	99.5	98.1
Light hydrocarbons							
NC_4, per cent volume	2.1	1.8	2.6	2.2	1.8	2.2	2.0
IC_4, volume	7.5	6.4	8.9	8.0	6.8	9.5	6.7
$C_4=$, volume	4.7	4.3	2.0	4.2	5.0	5.0	4.5
Total, volume	14.3	12.5	13.5	14.4	13.6	16.7	13.2
C_3, per cent weight	1.9	1.7	2.1	2.0	1.6	2.1	1.8
$C_3=$, weight	2.6	2.4	2.2	2.4	2.7	3.1	2.3
C_2 + lighter, weight	2.3	1.9	2.0	1.9	2.6	2.1	2.6
Total, weight	6.8	6.0	6.3	6.3	6.9	7.3	6.7
10 RVP TCC motor gasoline							
Yield, per cent volume	42.4	41.0	46.0	42.7	37.1	43.7	39.8
Excess C4's, volume	12.4	10.3	10.5	12.5	11.7	14.9	10.6
Octane numbers	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2
0 cc TEL	92.2 79.5	93.0 79.5	96.2 83.5	92.4 81.0	92.5 80.2	92.1 80.1	90.5 79.8
3 cc TEL	98.0 85.5	98.7 85.5	iso + 0.05 89.0	98.7 87.0	97.5 85.0	98.2 85.7	96.5 85.0
10 RVP TCC + C_4 alkylate motor gasoline							
Yield, per cent volume	51.3	48.2	49.7	50.6	45.5	53.3	47.4
Excess C_4's, volume	0.6	0.8	5.5	2.0	0.6	2.2	0.6
Octane numbers	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2
0 cc TEL	92.4 81.5	93.1 81.2	96.0 84.1	92.6 82.7	92.7 82.3	92.4 82.2	91.0 81.7
3 cc TEL	98.9 88.3	99.4 88.0	iso + 0.07 90.0	99.4 89.3	98.6 88.1	99.1 86.6	97.6 87.7
10 RVP TCC + catalytic $C_3= - C_4=$ polymer motor gasoline							
Yield, per cent volume	47.8	45.9	49.9	47.5	42.7	49.7	44.8
Excess C_4's, volume	7.9	6.2	8.6	8.5	7.0	10.1	6.3
Octane numbers	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2
0 cc TEL	93.6 80.7	94.2 80.7	97.3 84.3	93.6 81.9	94.0 81.5	93.6 81.3	92.2 80.9
3 cc TEL	98.4 85.8	98.9 85.8	iso + 0.11 89.3	98.9 87.1	98.0 85.5	98.6 86.0	97.1 85.4

TABLE 3. Properties of products from TCC cracking various charge stocks.

Charge stock	Mid-Continent wide cut gas oil			Mid-Continent heavy gas oil		Mirando wide cut gas oil		Scurry County wide cut gas oil		Slaughter West Texas gas oil		Tibn-Petrolea wide cut gas oil		Iranian mixture wide cut gas oil	
Product	10 RVP motor gasoline	Light fuel oil	Heavy fuel oil	10 RVP motor gasoline	Light fuel oil	10 RVP motor gasoline	Light fuel oil	10 RVP motor gasoline	Light fuel oil	10 RVP motor gasoline	Light fuel oil	10 RVP motor gasoline	Light fuel oil	10 RVP motor gasoline	Light fuel oil
Properties															
Gravity, API	57.4	28.4	23.5	58.3	23.8	50.9	20.5	58.1	25.8	57.9	25.3	59.3	28.8	58.8	31.3
Bromine number	63.2	11.2	.....	73.0	16.8	26.0	10.8	37.0	13.5	48.5	.....	54.4	9.6	57.0	.....
Aniline point, F	.....	147	178	.....	120	.....	99	.....	127	.....	127	.....	142	.....	144
Pour point, F	.....	10	75	.....	10	.....	−25	.....	15	.....	10	.....	10	.....	10
Sulfur, per cent weight	0.02	.42	0.59	0.06	.61	0.04	.14	0.04	.38	0.26	2.0	0.08	.84	0.13	1.20
Conradson carbon residue, % wt.	.....	<0.01	1.0	.....	0.01	.....	<0.01	.....	0.01	.....	0.02	.....	<0.01	.....	0.03
Viscosity, KV @ 100 F	.....	4.02	16.2	.....	4.11	.....	3.75	.....	3.90	.....	3.78	.....	3.79	.....	3.31
Viscosity, KV @ 210 F	.....	.....	3.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Distillation, F															
IBP	93	492	608	93	488	87	475	89	495	95	455	93	500	85	435
10 per cent volume	115	517	663	116	512	115	492	115	515	114	482	115	515	110	481
50 per cent volume	220	552	712	227	555	272	518	225	548	230	532	214	541	227	529
90 per cent volume	385	597	813	355	600	355	592	385	597	385	600	382	592	385	598
E.P.	425	620	.....	418	625	415	632	422	618	432	627	436	615	427	632
Cetane number	.....	51.5	.....	.....	34.5	.....	25	.....	39.8	.....	.....	.....	.....	.....	.....
Diesel index	.....	41.7	.....	.....	28.7	.....	20.2	.....	32.8	.....	32.1	.....	41.0	.....	45.0
	Heavy fuel oil							Heavy fuel oil		Heavy fuel oil		Heavy fuel oil		Heavy fuel oil	
Product															
Properties															
Gravity, API	22.0					13.4		597		19.8		28.8		23.9	
Bromine number	.....					.....		48.5		.....		9.6		183	
Aniline point, F	173					127		.....		.....		142		.....	
Pour point, F	80					50		.....		80		10		75	
Sulfur, per cent weight	0.52					0.30		0.26		2.78		0.08		0.02	
Conradson carbon residue, % wt.	1.10					6.0		.....		1.3		.....		1.2	
Viscosity, KV @ 100 F	18.5					500		.....		.....		.....		17.53	
Viscosity, KV @ 210 F	3.50					12.8		.....		3.60		.....		3.45	
Distillation, F															
IBP	610					597		89		600		93		637	
10 per cent volume	685					710		115		695		115		682	
50 per cent volume	720					754		225		755		214		718	
90 per cent volume	810					890		385		863		382		834	
E.P.	.....					.....		422		.....		436		.....	
Cetane number	.....					.....		.....		.....		.....		.....	
Diesel index	.....					.....		.....		.....		.....		.....	

viously mentioned the gasoline-to-coke ratio is very attractive in TCC operations. Thus it will be noted from the yields in the tables that the coke make is remarkably low for the gasoline yield at any given level. Table 4 shows the product yields from the Mid-Continent heavy gas oil at a carbon factor of 0.5, 0.67, and 0.83 lb per hour carbon per barrel per day feed. The change in conversion level and cracking severity for these operations is obtained by simultaneously decreasing space velocity and increasing catalyst-to-oil ratio at the same average reactor temperature. The net result, comparing the yields at 0.5 and 0.83 carbon factor, is an increase in conversion level from 51.6 to 66.5 per cent, which results in an increase in 10 RVP motor gasoline (from 41.0 to 50.8 per cent volume), excess butanes and dry gas, primarily at the expense of heavy fuel oil yield. The octane number of the motor gasoline remains about the same. The yield of alkylate increases from 7.2 to 9.5 per cent volume and the yield of catalytic polymer increases from 4.9 to 5.6 per cent volume.

Effect of Cracking Temperature

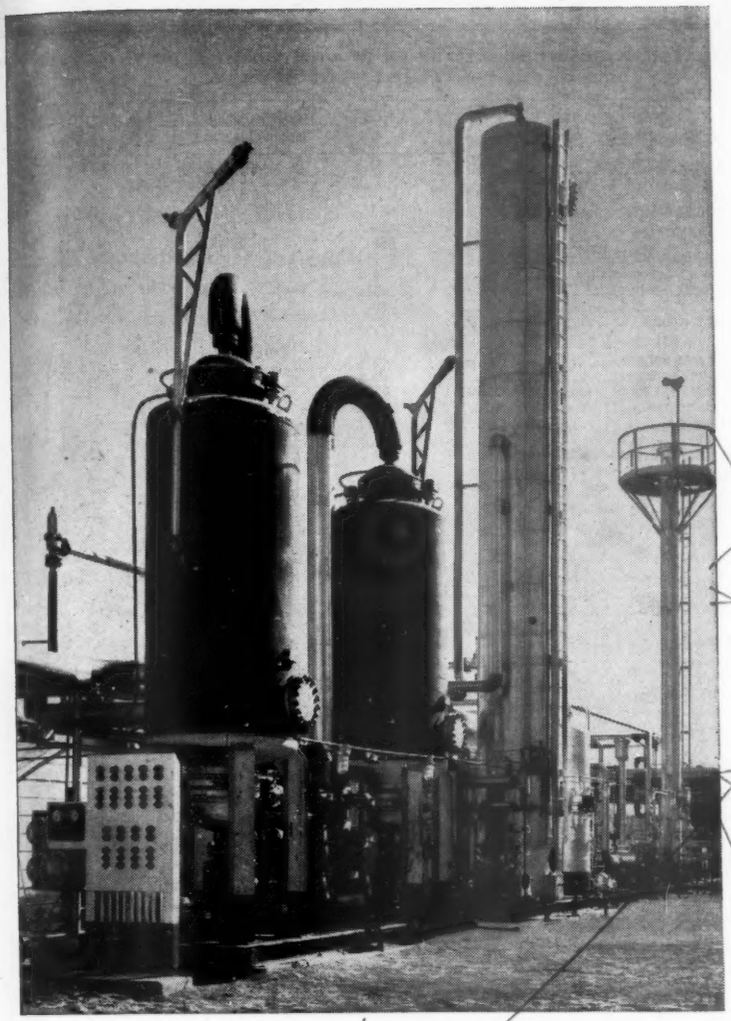
The effect of varying average reactor temperature on product yields at a constant coke production is shown in Table 5. These yields are based on cracking the Mid-Continent wide-cut gas oil at 860, 885, and 925 F at a 0.5 carbon factor. As temperature is increased, space velocity is also increased to maintain the same coke yield. The net result of increasing the temperature from 860 to 925 F in this manner is a loss in 10 RVP TCC motor gasoline (43.2 to 41.0 per cent volume), light fuel oil, and liquid recovery; and an increase in dry gas, total butanes, and unsaturates. In the TCC process an increase in temperature, with all other factors remaining constant, increases the octane number of the catalytic gasoline. Thus the leaded research octane number of the TCC gasoline increases 1.7 points for the temperature change noted above. The yield of total 10 RVP gasoline, including either alkylate or catalytic polymer, is essentially constant over the temperature range since the incremental gain in butylene and propylene due to the higher temperature is sufficient when converted to alkylate or polymer to just about offset the loss in TCC gasoline.

Effect of Recycle Cracking on Product Yields

In cases where charge stock availability is limited, recycling of catalytic gas oil is frequently practiced to meet gasoline production. Recycle operations are advantageous in TCC operations because the TCC recycle stocks are relatively less refractory than many recycle stocks. Hence, high gasoline yields are obtained from TCC recycle processing. In general, the preferred recycle stock is catalytic heavy fuel oil since it is the

TABLE 4. Effect of increasing coke production on product yields. Type of operation — once-through — catalyst — 31 AI beads.

Charge stock	Mid-Continent heavy gas oil					
Cut on crude	59.7–89.5					
Operating conditions						
Oil inlet temp., F	810		810		810	
Catalyst inlet temp., F	1050		1015		990	
Average reactor temp., F	885		885		885	
Space velocity, total feed, V/Hr/V	2.0		1.4		1.0	
Catalyst to total feed ratio, volume	4.7		6.2		7.9	
Steam, per cent weight total feed	5.0		5.0		5.0	
Pressure, psig	10		10		10	
Conversion, per cent volume	51.6		59.4		66.5	
Yields on fresh feed						
Heavy fuel oil, per cent volume	30.9		24.4		18.0	
Light fuel oil, per cent volume	17.5		16.1		15.5	
C_4 free motor gasoline, 385 @ 90 per cent, per cent vol	38.8		44.0		47.9	
Total C_4's, per cent volume	12.5		14.5		16.5	
Dry gas, per cent weight	6.0		6.7		7.7	
Coke, per cent volume	3.8		5.1		6.4	
C_3 free liquid recovery, per cent volume	99.7		99.0		97.9	
Light hydrocarbons						
NC_4, per cent volume	1.8		2.2		2.6	
IC_4, per cent volume	6.4		7.7		9.0	
C_4=, per cent volume	4.3		4.6		4.9	
Total, per cent volume	12.5		14.5		16.5	
C_3, per cent weight	1.7		2.0		2.3	
C_3=, per cent weight	2.4		2.5		2.7	
C_2 + lighter, per cent weight	1.9		2.2		2.7	
Total, per cent weight	6.0		6.7		7.7	
10 RVP TCC motor gasoline						
Yield, per cent volume	41.0		46.4		50.8	
Excess C_4's, per cent volume	10.3		12.1		13.6	
Octane numbers	F-1	F-2	F-1	F-2	F-1	F-2
0 cc TEL	93.0	79.5	92.8	79.4	93.1	79.6
3 cc TEL	98.7	85.5	98.5	85.4	98.9	85.6
10 RVP TCC + C_4 alkylate motor gasoline						
Yield, per cent volume	48.2		55.1		60.3	
Excess C_4's, per cent volume	0.8		0.7		1.2	
Octane numbers	F-1	F-2	F-1	F-2	F-1	F-2
0 cc TEL	93.1	81.2	92.9	81.3	93.2	81.5
3 cc TEL	99.4	88.0	99.2	88.1	99.6	88.2
10 RVP TCC + catalytic C_3= — C_4= polymer motor gasoline						
Yields, per cent volume	45.9		51.7		56.4	
Excess C_4's, per cent volume	6.2		7.6		8.9	
Octane numbers	F-1	F-2	F-1	F-2	F-1	F-2
0 cc TEL	94.2	80.7	93.9	80.5	94.3	81.0
3 cc TEL	98.9	85.8	98.8	85.7	99.1	86.0



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lowest value liquid product. If the quantity of heavy fuel oil is insufficient to fill a unit to capacity, or to meet a specific product distribution, then the catalytic light fuel oil is included in the recycle stream. The effect of recycling heavy and wide-cut catalytic fuel oils on the products from processing the Mid-Continent wide-cut gas oil is presented in Table 6. The operating variables were held constant in all cases with the exception of space velocity, which is adjusted as recycle to fresh feed ratio is changed to keep the coke production (weight per cent of total feed) constant.

Recycling a 600 to 800 F catalytic heavy fuel oil to the extent of 0.3 recycle to 1 fresh feed results in an increase in conversion level from 55.5 per cent to 65.2 per cent and increases the yield of 10 RVP TCC gasoline from 42.4 to 48.7 per cent volume. The octane quality of the gasoline remains about the same. The change in yields when recycling a 400 to 800 F fraction is similar to that for recycling a heavy gas oil, except that the gain in yields is at the expense of both heavy and light fuel oils. The operation at a recycle to fresh feed ratio of 1.5 shows a 10 RVP TCC gasoline yield of 63.6 per cent volume at a conversion level of 93 per cent. This yield of gasoline can be increased to 73.5 per cent volume if catalytic polymer is included or to 79.1 per cent volume if alkylate is included. As the amount of recycling is increased, a slight rise in average reactor temperature occurs at the same oil and catalyst inlet temperatures. This increase in average reactor temperature results in a small increase in octane quality of the gasoline.

Selection of Optimum Process Conditions

The effects of the individual process variables have been discussed in the preceding paragraphs primarily with respect to gasoline yield. The selection of a set of process conditions for a specific installation requires study of a number of cases selected to fit in with the existing processing facilities and the desired product distribution and quality. The cost of each operation (feed preparation, cracking, fuel blending, and light ends recovery) and the product revenue from each case must be evaluated in order to select the optimum processing scheme.

Yields from Commercial Airlift Units

All the data presented up to this point are representative of commercial operation but are based on pilot plant information, which, as noted later, checks commercial operations closely. Typical yields from 5 Airlift units, each designed for a charge rate of 15,000 bbl per day and a carbon burnoff of 7500 lb per hour are shown in Table 7.

Units 1 and 2 were processing vaporized gas oils; No. 1 a Jackson gas oil and No. 2 a mixture of Mid-Continent and West Texas virgin and visbroken gas oils. The remaining three units were charging a mixed vapor-liquid feed, No. 3 a Mid-Continent gas oil containing 10

TABLE 5. Effect of temperature severity on product yields. Type of operation — once-through — catalyst — 31 AI bead.

Charge stock	Mid-Continent wide cut gas oil		
Cut on crude, per cent volume	44.5-89.5		
Operating conditions			
Average reactor temp., F	860	885	925
Oil inlet temp., F	810	810	810
Catalyst inlet temp., F	985	1035	1115
Space velocity, total feed, V/Hr/V	1.15	1.3	1.6
Catalyst to total feed ratio, volume	4.7	4.7	4.7
Steam, per cent weight total feed	5.0	5.0	5.0
Pressure, psig	10	10	10
Conversion, per cent volume	55.1	55.5	56.0
Yields on fresh feed			
Heavy fuel oil, per cent volume	18.5	18.1	18.9
Light fuel oil, per cent volume	26.4	26.4	25.1
C_4 free motor gasoline, 385 @ 90 per cent, per cent vol	41.3	40.5	39.1
Total C_4's, per cent volume	13.8	14.3	14.4
Dry gas, per cent weight	6.0	6.8	8.2
Coke, per cent weight	3.9	3.9	3.9
C_3 free liquid recovery, per cent volume	100.0	99.3	97.5
Light hydrocarbons			
NC_4, per cent volume	2.0	2.1	1.9
IC_4, per cent volume	7.8	7.5	7.1
C_4=, per cent volume	4.1	4.7	5.4
Total	13.8	14.3	14.4
C_3, per cent weight	1.8	1.9	2.1
C_3=, per cent weight	2.3	2.6	3.1
C_2 + lighter, per cent weight	1.9	2.3	3.0
Total, per cent weight	6.0	6.8	8.2
10 RVP TCC motor gasoline			
Yield, per cent volume	43.2	42.4	41.0
Excess C_4's, per cent volume	11.9	12.4	12.5
Octane numbers	F-1 F-2	F-1 F-2	F-1 F-2
0 cc TEL	90.5 79.0	92.2 79.5	94.0 80.3
3 cc TEL	97.3 85.5	98.0 85.5	99.0 85.5
10 RVP TCC + C_4 alkylate motor gasoline			
Yield, per cent volume	51.0	51.3	47.9
Excess C_4's, per cent volume	1.7	0.6	0
Octane numbers	F-1 F-2	F-1 F-2	F-1 F-2
0 cc TEL	91.0 80.9	92.4 81.5	93.9 82.3
3 cc TEL	98.3 88.0	98.9 88.3	99.8 88.5
10 RVP TCC + catalytic C_3= + C_4= polymer motor gasoline			
Yield, per cent volume	47.9	47.8	47.2
Excess C_4's, per cent volume	8.0	7.9	7.4
Octane numbers	F-1 F-2	F-1 F-2	F-1 F-2
0 cc TEL	92.0 80.1	93.6 80.7	95.2 81.5
3 cc TEL	97.7 85.8	98.4 85.8	99.3 85.9

TABLE 6. Effect of recycle cracking on product yields. Catalyst — 31 AI beads.

Charge stock	Mid-Continent wide cut gas oil				
Cut on crude, per cent volume	44.5-89.5				
Operating conditions					
Recycle to fresh feed ratio, volume	0	0.3	0.5	1.0	1.5
Oil inlet temp., F	810	810	810	810	810
Catalyst inlet temp., F	1035	1035	1035	1035	1035
Average reactor temp., F	885	885	890	895	900
Space velocity, total feed, V/Hr/V	1.3	1.7	1.6	1.8	1.9
Catalyst to total feed ratio, volume	4.7	4.7	4.7	4.7	4.7
Steam, per cent weight total feed	5.0	5.0	5.0	5.0	5.0
Pressure, psig	10	10	10	10	10
Recycle					
Gravity, API	.....	22.5	25.0	22.5	20.0
Boiling range, F	.....	600-800	400-800	400-800	400-800
Conversion, per cent volume	55.5	65.2	73.6	84.8	93.0
Yields on fresh feed					
Heavy fuel oil, per cent volume	18.1	7.0	11.0	8.0	5.9
Light fuel oil, per cent volume	26.4	27.8	15.4	7.2	1.1
C_4 free motor gasoline, 385 @ 90 per cent, per cent vol	40.5	46.6	51.6	57.8	61.6
Total C_4's, per cent volume	14.3	17.1	19.4	22.4	24.4
Dry gas, per cent weight	6.8	8.3	9.8	11.8	13.7
Coke, per cent weight	3.9	5.1	5.9	7.8	9.7
C_3 free liquid recovery, per cent volume	99.3	98.5	97.4	95.4	93.0
Light hydrocarbons					
NC_4, per cent volume	2.1	2.6	3.0	3.5	3.8
IC_4, per cent volume	7.5	8.8	9.9	11.4	12.4
C_4=, per cent volume	4.7	5.7	6.5	7.5	8.2
Total, per cent volume	14.3	17.1	19.4	22.4	24.4
C_3, per cent weight	1.9	2.1	2.5	2.9	3.2
C_3=, per cent weight	2.6	3.3	3.8	4.5	5.2
C_2 + lighter, per cent weight	2.3	2.9	3.5	4.4	5.3
Total, per cent weight	6.8	8.3	9.8	11.8	13.7
10 RVP TCC motor gasoline					
Yield, per cent volume	42.4	48.7	53.7	59.8	63.6
Excess C_4's, per cent volume	12.4	15.0	17.3	20.4	22.4
Octane numbers	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2
0 cc TEL	92.2 79.5	92.2 79.5	92.5 79.7	92.7 79.9	93.0 80.0
3 cc TEL	98.0 85.5	98.0 85.5	98.2 85.6	98.4 85.7	98.5 85.8
10 RVP TCC + C_4 alkylate motor gasoline					
Yield, per cent volume	51.3	59.5	66.0	74.0	79.1
Excess C_4's per cent volume	0.6	0.8	1.0	1.7	1.9
Octane numbers	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2
0 cc TEL	92.4 81.5	92.4 81.7	92.7 81.9	92.9 82.1	93.1 82.3
3 cc TEL	98.9 88.3	98.9 88.5	99.1 88.7	99.3 88.8	99.4 89.0
10 RVP TCC + catalytic C_3= + C_4= polymer motor gasoline					
Yield, per cent volume	47.8	55.2	61.3	68.6	73.5
Excess C_4's, per cent volume	7.9	9.6	11.1	13.3	14.6
Octane numbers	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2	F-1 F-2
0 cc TEL	93.6 80.7	93.6 80.8	93.9 81.0	94.2 81.2	94.5 81.3
3 cc TEL	98.4 85.8	98.4 85.9	98.6 86.0	98.8 86.1	98.9 86.2

per cent volume of liquid feed, No. 4 a Kansas gas oil containing 6 per cent volume of liquid feed, and No. 5 an Illinois gas oil containing 11 per cent volume of liquid feed. Units 3 and 5 are recycling heavy catalytic gas oil, No. 3 at 0.28 to 1 and unit No. 5 at 0.16 to 1 recycle to fresh feed ratio. The other three are essentially once-through operations.

The yield of 10 RVP-385 F at 90 per cent motor gasoline from these operations varies from 42.7 per cent volume for Jackson oil at low severity (51.3 per cent conversion) for No. 1 unit to 52.2 per cent volume for Illinois gas oil at moderately high severity (64.9 per cent conversion) for No. 5 unit.

The gasoline yields from all these operations could be increased as none of the units are operating at the maximum coke-burning capacity (7500 lb per hr). Units 1, 2, and 3 were not operated at maximum severity but rather to maximize the yield of No. 2 fuel oil; while Units 4 and 5 did not have adequate charge stock to run at full capacity. At various times, however, it has been demonstrated that the units are capable of smooth and easy operation at carbon-burning rates of 7500 lb per hour and higher.

The octane quality of the motor gasolines is in the range of 94 to 97 F-1 plus 3 cc TEL. As all these operations are at about the same average reactor temperature (850-870 F) the differences in octane ratings, for the most part, reflect the gasoline content of the feed. For example, the Jackson gas oil feed to unit No. 1 contained 8 per cent volume of gasoline due to inadequate feed-preparation facilities in the refinery. Where direct checks are available, as will be shown later, the quality of the gasoline produced commercially is equivalent to that produced in the pilot unit.

A characteristic of the TCC process, which has marked commercial significance, is the high liquid recoveries (C_4 and heavier) that are obtained. It will be seen in Table 7 that the commercial liquid recoveries (C_4 and heavier) are very high, ranging from 99.7 for Unit No. 2 to 98.1 for Unit No. 4.

TABLE 7. Yields from commercial airlift TCC units.

Airlift TCC unit number	1	2	3	4	5
Charge stock	Jackson gas oil	Mixture Mid-Continent and West Texas virgin and visbroken gas oils	Mid-Continent wide-cut gas oil	Kansas wide cut gas oil	Illinois wide cut gas oil
Fresh feed, B/SD	17790	15740	11486	11420	7800
Gasoline content, per cent volume	8	10	5	2	2
Gravity, API of fresh feed	30.7	31.2	32.5	28.9	28.2
Distillation, ASTM, F					
IBP	296	308	280	300	312
10 per cent volume	412	406	460	535	542
50 per cent volume	556	606	605	633	692
90 per cent volume	716	742	745	727	750
95 per cent volume	750	760+	760+	745	760+
Liquid feed, per cent volume	....	....	10	6	11
Operating conditions					
Bead catalyst activity index	34	32.5	28	32	34
Oil inlet temp., F	795	800	760 761[1]	782 600[1]	786 686[1]
Catalyst inlet temp., F	1030	980	1050	947	944
Average reactor temp., F	870	860	865	840	850
Space velocity, total feed, V/Hr/V	1.90	1.67	1.3	0.98	1.06
Catalyst to total feed ratio, volume	3.2	4.0	3.9	5.5	7.1
Steam, per cent weight total feed	3.1	3.8	2.3	8.8	3.5
Pressure, psig	10	10	8	7	8
Recycle to fresh feed ratio, volume	....	....	0.28	0.03	0.16
Total feed rate, B/SD	17790	15740	14669	11810	9050
Catalyst circulation rate, tons/hr	285	310	280	324	320
Carbon burnoff, lbs/hr	4520	6190	5090	7000	6150
Yields on fresh feed					
Heavy fuel oil, per cent volume	7.5	15.0	9.2	19.1	9.0
Light fuel oil, per cent volume	41.2	30.5	32.4	19.9	26.1
C_4 free motor gasoline, 385 F @ 90 per cent, per cent vol	39.7	40.9	46.0	42.3	49.5
Total C_4's per cent volume	11.0	13.3	11.1	16.8	13.9
Dry gas, per cent weight	4.9	5.5	5.6	8.9	7.1
Coke, per cent weight	2.0	3.1	3.5	4.8	6.1
C_3 free liquid recovery, per cent volume	99.4	99.7	98.7	98.1	98.5
Light hydrocarbons					
NC_4, per cent volume	1.2	1.8	2.0	2.5	2.3
IC_4, per cent volume	5.8	6.7	4.5	8.7	7.2
C_4=, per cent volume	4.0	4.8	4.6	5.6	4.4
Total, per cent volume	11.0	13.3	11.1	16.8	13.9
C_3, per cent weight	1.2	1.5	1.4	2.1	1.5
C_3=, per cent weight	2.2	2.3	2.0	3.9	2.8
C_2 + lighter, per cent weight	1.5	1.7	2.2	2.9	2.8
Total, per cent weight	4.9	5.5	5.6	8.9	7.1
10 RVP motor gasoline					
Yield, per cent volume fresh feed	42.7	43.5	48.5	44.8	52.2
F-1 + 0 cc TEL	....	....	87.5	88.7	88.8
F-1 + 3 cc TEL	95.9	94.2	95.5	96.5	96.5

[1] Liquid feed temperature.

Yield Comparison — Commercial, Pilot Plant Operation

A comparison of the yields and operating conditions for commercial and pilot plant operations has been made in two cases. Accurate yield surveys were taken on Units 1 and 3 and samples of catalyst and charge stock from these units were used to make pilot plant runs. A comparison of the results between pilot plant and commercial operations at the same operating conditions is shown in Table 8. It will be noted that the yields of all products show good agreement and that octane ratings of the motor gasolines are also in good agreement.

TABLE 8. Comparison of commercial and pilot plant TCC yields at the same operating conditions.

Charge stock	Jackson gas oil		Mid-Continent wide cut gas oil	
Unit	Commercial No. 1	Pilot plant	Commercial No. 3	Pilot plant
Yields, on fresh feed				
Heavy fuel oil, per cent volume	7.5	7.0	9.2	13.6
Light fuel oil, per cent volume	45.9	46.5	35.9	31.4
C_4 free motor gasoline, per cent volume	35.0	35.3	42.5	42.1
Total C_4's, per cent volume	11.0	11.0	11.1	11.5
Dry gas, per cent weight	4.9	5.3	5.6	5.8
Coke, per cent weight	2.0	2.2	3.5	3.6
C_3 free liquid recovery, per cent volume	99.4	99.8	98.7	98.6
Light hydrocarbons				
NC_4	1.2	1.6	2.0	1.7
IC_4	5.8	6.2	4.5	5.3
C_4=	4.0	3.2	4.6	4.5
Total	11.0	11.0	11.1	11.5
C_3	1.2	1.6	1.4	1.3
C_3=	2.2	2.2	2.0	2.1
C_2 + lighter	1.5	1.5	2.2	2.4
Total	4.9	5.3	5.6	5.8
10 RVP motor gasoline				
Yield, per cent volume fresh feed	37.4	37.4	45.0	44.6
F-1 + 0 cc TEL	....	....	87.9	87.5
F-1 + 3 cc TEL	96.6	95.6	95.7	95.5

Aviation Gasoline Blending Stocks

During World War II the TCC process was used to produce large volumes of aviation base stock, which was blended into Grade 100/130 aviation gasoline. Two types of processing were commonly used; (1) one-pass reforming of a naphthenic or aromatic kerosine, to produce base stock by recycling the charge to extinction, and (2), two-pass processing of light gas oils. In the latter case, gas oil was first cracked to produce a motor gasoline that was then reprocessed with recycling of the heavy naphtha to produce base stock.

The new Airlift TCC units can likewise be used to produce an aviation gasoline base stock by these techniques, with quality equivalent to or better than that produced by the World War II bucket-elevator TCC units. For example, two-pass processing of a paraffinic gas oil gives a 7 RVP base stock yield of 36.0 per cent volume based on gas oil, having octane ratings with 4.6 cc TEL of 97.6 F-3 and Isooctane + 1.64 cc TEL F-4 as shown in Table 9. Up to 74 per cent volume of this material can be

blended with alkylate to make Grade 100/130 aviation gasoline. With an aromatic or naphthenic type charge, both the octane quality and the blend proportions of the base stock will be higher.

It is considerably more difficult to produce a catalytic base stock suitable for blending in Grade 115/145 aviation gasoline than for the Grade 100/130. In this case two-pass processing of selected charge stocks must be employed. Thus, the charge to the first pass should be as aromatic or naphthenic as possible; moreover, the first-pass aviation fraction must be removed and only the 325-450 F fraction charged to the second pass. By applying this technique to a California (naphthenic) gas oil, a 7 RVP base stock yield of 19.6 per cent volume having an F-3 rating of 100 and an F-4 blending index of 169 with 4.6 cc TEL was produced, as shown in Table 10. Up to 30.8 per cent volume of this product can be blended with alkylate to make Grade 115/145 aviation gasoline. The pentane cut produced from the process requires refractionation to prepare a high-purity isopentane for pressuring the Grade 115/145 aviation gasoline. In addition to this high quality aviation base stock, 23.3 per cent volume of a 300 F EP gasoline fraction for motor gasoline blending is produced in the first-pass operation.

Application of TCC Cracking to Refinery Processing

The preceding part of this paper has described the effects of operating variables and types of charge stock on TCC yields. In order to illustrate the effect of TCC cracking on overall refinery yields, 5 TCC processing schemes were developed for a typical refinery processing 30,000 bbl per day of 38.5 API Mid-Continent crude. These 5 schemes are as follows:

1. TCC cracking 15,000 bbl per day of virgin wide-cut gas oil.

2. TCC cracking 10,000 bbl per day of virgin heavy gas oil.

3. TCC cracking 10,000 bbl per day of virgin heavy gas oil and 5000 bbl per day of TCC heavy recycle gas oil.

4. TCC cracking 10,000 bbl per day of virgin heavy gas oil, 1180 bbl per day of coker gas oil and 3820 bbl per day of TCC recycle heavy gas oil.

5. TCC processing 27,750 bbl per day of deasphalted whole crude.

For Cases 1 to 3, the refinery comprises facilities for crude topping through kerosine or No. 2 fuel oil, TCC feed preparation by tar separation and vacuum flashing, TCC cracking, vis-breaking the vacuum tar, catalytic reforming the heavy naphtha, and catalytic polymerization. A 10 RVP yield of 95.3 per cent volume at 95 leaded F-1 octane number was assumed for catalytic reforming. In Case 4, coking is substituted for vis-breaking to minimize the yield of residual fuel. The principal refinery products are 10 RVP motor gasoline—89.8 octane number (70 per cent regular grade of 88 octane number and 30 per cent premium grade of 94 octane number with lead contents not exceeding 2.2 cc per gallon, kerosine, No. 2 fuel oil and residual fuel. Case 5 represents an operation projected for refineries where it is desirable to hold the types of processing equipment to a minimum. This scheme involves only TCC and catalytic polymerization units. The products produced are motor gasoline, No. 2 fuel oil and heavy fuel oil. This type of operation is somewhat restricted with regard to octane level compared to Cases 1 to 4 involving catalytic reforming since only mild reforming of the straight run naphtha occurs in the TCC unit. However, the high ratio of catalytic cracking to crude results in a high yield of good quality gasoline. A summary of the refinery yields for these five cases is shown in Table 11.

The liquid recoveries, with excess C_3's and C_4's included as LPG, range from 99.1 to 100.6 per cent volume for the various schemes. The kerosine yield was maintained constant at 10 per cent volume except in Case 5. The yields of other major products varied as follows.

In Case 1, a refinery gasoline yield of 55.2 per cent volume is obtained for once-through TCC processing the wide-cut gas oil in a 15,000 bbl per day unit with a carbon-burning capacity of 7500 lb per hour. This gasoline requires only 1.1 cc TEL/gal to meet the refinery octane number specification of 89.8. The No. 2 and residual fuel oil yields are 14.0 and 15.8 per cent volume, respectively.

Case 2, with a 10,000 bbl per day TCC unit for once-through processing the heavy gas oil, gives a gasoline yield of 43.5 per cent volume with a lead requirement of 1.9 cc TEL per gal. The high lead requirement for this case is due to the lower percentage of catalytic gasoline in the refinery product. The No. 2 and residual fuel oil yields for this case are 26.0 and 17.4 per cent volume, respectively.

TABLE 9. Two-pass TCC processing for production of grade 100/130 aviation gasoline base stock. Catalyst — 31 AI beads.

Operation	Cracking	Treating
Charge stock	Tibu-Petrolea gas oil	First pass catalytic wide cut naphtha
Boiling range	370–650	C_6–450
Operating conditions		
Oil inlet temp., F	820	900
Catalyst inlet temp., F	1050	1050
Average reactor temp., F	900	965
Space velocity, total feed, V/Hr/V	1.0	1.0
Catalyst to total feed ratio, volume	4.7	4.7
Steam, per cent weight total feed	0	0
Pressure, psig	10	10
Recycle to fresh feed ratio, volume	.....	0.67
Recycle		
Gravity, API	.....	37.9
Boiling range, F	.....	335–500
Yields on fresh feed		
Heavy fuel oil, per cent volume	3.2	4.6
Light fuel oil, per cent volume	21.7	.....
C_5 free — 450 F EP, per cent volume	50.6	.....
C_5 free 290 F @ 90 per cent, per cent volume	.....	55.5
Total C_3's, per cent volume	6.2	8.6
Total C_4's, per cent volume	14.5	15.0
Dry gas, per cent weight	7.9	14.0
Coke, per cent weight	3.1	6.2
C_5 free liquid recovery, per cent volume	96.2	83.7
Light hydrocarbons		
NC_5, per cent volume	1.0	0.7
IC_5, per cent volume	3.1	5.2
C_5=, per cent volume	2.1	2.7
Total, per cent volume	6.2	8.6
NC_4, per cent volume	2.0	2.4
IC_4, per cent volume	7.6	8.8
C_4=, per cent volume	4.9	3.8
Total, per cent volume	14.5	15.0
C_3, per cent weight	2.3	4.3
C_3=, per cent weight	3.3	4.2
C_3 + lighter, per cent weight	2.3	5.5
Total, per cent weight	7.9	14.0

Stock	Gas oil charge	1-pass catalytic treater charge	7 RVP base stock	Grade 100/130 aviation gasoline
Yield, based on gas oil charge, per cent volume	100.0	50.6	36.0	48.6*
Properties				
Gravity, API	34.9	48.8	55.6	60.4
R.V.P.	.....	.....	7.1	7.2
Accelerated gum, mgs/100 ml	.....	.....	1.4	.....
Aromatics, per cent volume	.....	.....	37.5	.....
Aniline point, F	141	.....	.....	.....
Sulfur, per cent weight	0.35	.....	0.016	.....
Distillation, ASTM, F				
IBP	368	152	98	96
10 per cent	435	196	142	143
50 per cent	482	306	205	195
90 per cent	613	406	290	286
EP	653	444	310	315
Octane ratings				
F-3 + 4.6 cc TEL	.....	.....	97.6	100.0
F-4 + 4.6 cc TEL	.....	.....	iso + 1.64	iso + 1.83
F-4 AN performance number	.....	.....	134.5	136.5

* Represents blend of 74 per cent base stock plus 26 per cent alkylate. The octane ratings of the 7 RVP alkylate are 106.3 (F-3) blending octane number and 138.9 (F-4) index number.

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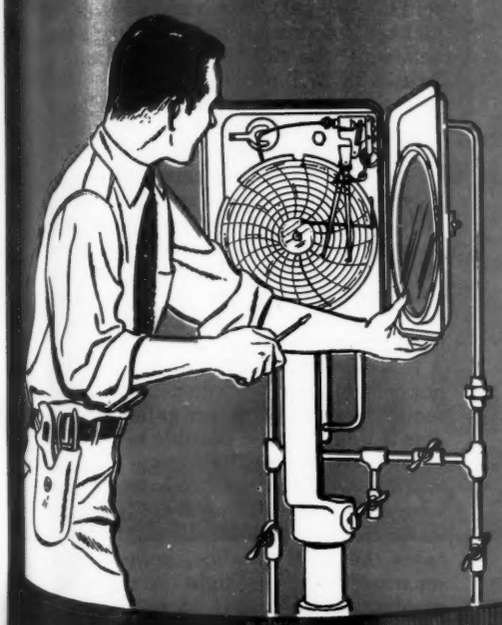

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TABLE 10. Two-pass TCC processing for production of grade 115/145 aviation gasoline base stock. Catalyst — 31 AI beads.

Operation	Cracking	Treating
Charge stock	Kettleman gas oil	First pass catalytic heavy naphtha
Boiling range	380–650	325–450
Operating conditions		
Oil inlet temp., F	820	820
Catalyst inlet temp., F	1050	1050
Average reactor temp., F	900	920
Space velocity, total feed, V/Hr/V	1.0	1.1
Catalyst to total feed ratio, volume	4.7	4.7
Steam, per cent weight total feed	0	0
Pressure, psig	10	10
Recycle to fresh feed ratio, volume	.....	1.36
Recycle		
Gravity, API	.....	29.4
Boiling range, F	.....	345–520
Yields on fresh feed		
Heavy fuel oil, per cent volume	3.5	5.1
Light fuel oil, per cent volume	27.2	.....
325–450 F, per cent volume	32.0	.....
C_3 free 291 F @ 90 per cent, per cent volume	17.0	47.7
Total C_3's, per cent volume	5.0	10.0
Total C_4's, per cent volume	12.0	19.0
Dry gas, per cent weight	7.5	16.5
Coke, per cent weight	3.4	9.6
C_3 free liquid recovery, per cent volume	96.7	81.8
Light hydrocarbons		
NC_3, per cent volume	0.8	0.9
IC_3, per cent volume	3.0	7.1
C_3=, per cent volume	1.2	2.0
Total, per cent volume	5.0	10.0
NC_4, per cent volume	2.0	3.1
IC_4, per cent volume	5.9	12.4
C_4=, per cent volume	4.1	3.5
Total, per cent volume	12.0	19.0
C_3, per cent weight	2.3	5.1
C_3=, per cent weight	2.7	3.3
C_2 + lighter, per cent weight	2.5	8.1
Total, per cent weight	7.5	16.5
10 RVP motor gasoline, 291 F @ 90 per cent		
Yield, per cent volume fresh feed	23.3	.....
Octane numbers	CFRM / CFRR	CFRM / CFRR
0 cc TEL	79.5 / 93.8	.... / ....
3 cc TEL	86.0 / 99.0	.... / ....

Stock	Gas oil charge	1-pass catalytic treater charge	7 RVP base stock	Grade 115/145 avi. gasoline
Yield, based on gas oil charge, per cent volume	100.0	32.0	20.7	72.4*
Properties				
Gravity, API	32.8	35.5	49.7	66.9
R.V.P.	.....	.....	6.9	7.3
Accelerated gum, mgs/100 ml	.....	.....	2.0	.....
Aromatics, per cent volume	.....	.....	60.2	.....
Aniline point, F	139	.....	.....	.....
Sulfur, per cent weight	0.45	.....	0.022	.....
Distillation, ASTM, F				
IBP	379	323	99	100
10 per cent	450	355	151	125
50 per cent	509	397	251	215
90 per cent	607	435	291	255
EP	656	451	320	295
Octane ratings				
F-3 + 4.6 cc TEL AN performance number	.....	.....	100.0	115.0
F-4 + 4.6 cc TEL	.....	.....	.....	iso + 2.81
F-4 AN performance number	.....	.....	.....	145.2
F-4 blending index (ACAC)	.....	.....	168.4	.....

* Represents blend of 29 per cent base stock plus 71 per cent alkylate. The octane ratings of the 7 RVP alkylate are 106.3 (F-3) blending octane number and 138.9 (F-4) index number.

TABLE 11. Summary of refinery processing schemes.

Scheme number	1	2	3	4	5
TCC charge stock	Wide cut gas oil	Heavy gas oil			Deasphalted crude
Cut on crude, per cent volume	42.5 to 92.5	59.2 to 92.5			0—92.5
Process equipment					
TCC, B/D virgin feed	15,000	10,000	10,000	11,180[3]	27,750
B/D recycle	.....	.....	5,000	3,820	.....
Coke burning capacity, lb/hr	7,500	5,000	7,500	7,500	12,500
Visbreaker, B/D virgin feed	2,250	2,250	2,250	.....	.....
Coker, B/D virgin feed	.....	.....	.....	2,250	.....
Yields based on crude					
10 RVP motor gasoline [3], per cent volume	55.2	43.5	49.9	51.8	60.3
Kerosene, per cent volume	10.0	10.0	10.0	10.0	....
No. 2 fuel oil, per cent volume	14.0	26.0	27.1	30.8	14.8
No. 6 fuel oil, per cent volume	15.8	17.4	9.3	1.9	15.9
Excess B-B stock, per cent volume	3.2	1.8	2.3	2.3	5.6
C_3's after cat-poly, per cent volume	2.2	1.5	2.0	2.3	3.1
Total	100.4	100.2	100.6	99.1	99.7
Refinery fuel gas, [1] FOE, per cent volume	2.8	1.7	2.4	2.9	3.7
Coke product, per cent weight	....	....	....	2.3	....
F-1 octane numbers of 10 RVP gasoline					
Clear	83.5	80.8	82.9	82.7	79.9
+ 3 cc TEL/gal	93.1	91.5	92.8	92.6	91.4
cc TEL/gal @ 89.8 octane number	1.1	1.9	1.3	1.4	2.2
No. 6 fuel oil, SSF @ 122 F	50	50	150	15	50

1 Includes 22.5 per cent of the total C_3's and 5 per cent of the total C_4's not recovered in gas plant.
2 Includes 1180 B/D coker gas oil.
3 Catalytic gasolines from cases 1 to 4 have 90 per cent points of 385 F. In case 5 the catalytic gasoline has a 90 per cent point of 330 F as a specification boiling range number 2 fuel oil must be made directly off the unit.

In Case 3, the catalytic gas oil is processed with a recycle to fresh feed ratio of 0.50 in a 15,000 bbl per day unit. Recycle cracking increases the refinery gasoline in 40.9 per cent volume. (1.3 cc TEL per gal). The yield of residual fuel oil is decreased to 9.3 per cent volume while the yield of No. 2 fuel oil increases to 27.1 per cent volume.

In Case 4, a coking unit is substituted for the vis-breaker and an 800 F EP coker gas oil is processed in the TCC unit in place of some catalytic gas oil recycle. In this case the residual fuel oil yield is reduced to 1.9 per cent volume on crude and the gasoline and No. 2 fuel oil yields are 51.8 and 30.8 per cent volume, respectively. The refinery gasolines requires 1.4 cc TEL per gallon to meet the octane rating of 89.9.

In Case 5, the yield of gasoline is 60.3 per cent volume on crude and has a lead requirement of 2.2 cc per gallon. In this case it would not be possible to increase the octane quality of premium gasoline much above 94 because there is only one source of gasoline, catalytic polymer, above this octane level. In all the other cases the TCC gasoline, because it is separate from the light straight run gasoline, has a leaded (3 cc TEL) octance number of 98 to 99. The No. 2 and residual fuel oil yields for Case 5 are 14.8 and 15.9 volume, respectively.

Summary

The Airlift Thermofor catalytic cracking process is a widely accepted method for producing motor gasoline. The Airlift TCC unit offers many improvements over the bucket-elevator TCC unit while retaining the advantages of high liquid recovery and high gasoline-to-coke ratio associated with the older unit. Yields of motor gasoline on once-through operations range from 37.1 per cent volume for Slaughter gas oil to 46.0 per cent volume for Mirando gas oil at the same carbon factor of 0.5. The respective leaded F-1 octane ratings are 97.5 and Isooctane + 0.05 for these gasolines. Increasing the conversion from 51.6 per cent to 66.5 per cent, which raises the carbon factor from 0.5 to .83 in the TCC process increases the TCC gasoline production by 20 to 25 per cent.

Product distribution in commercial units is as predicted by pilot plant tests. The commercial units are operating with low catalyst attrition rates and are more than meeting design conditions with respect to both yields and carbon-burning capacity.

The Airlift TCC unit can be used to produce substantial quantities of grade 100/130 aviation gasoline base stock in case of an all-out war. On selected stocks, limited quantities of 115/145 aviation gasoline base stock can also be produced.

References

1. Twin Airlift Thermofor Cat Cracking Units on Stream, *The Petroleum Engineer*, Volume 23, April 1951.
2. First Airlift TCC Unit, *Petroleum Processing*, Volume 6, 147, February 1951.
3. Catalyst Airlift System, *Oil and Gas Journal*, Volume 50, June 28, 1951.
4. Two New Airlift Type TCC Units Put Into Operation, *Petroleum Refiner*, Volume 30, No. 3, March 1951.

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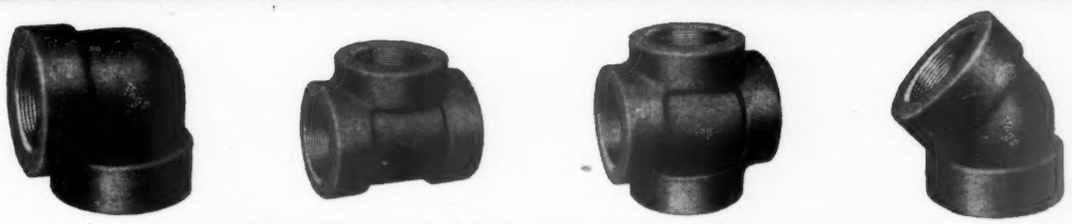

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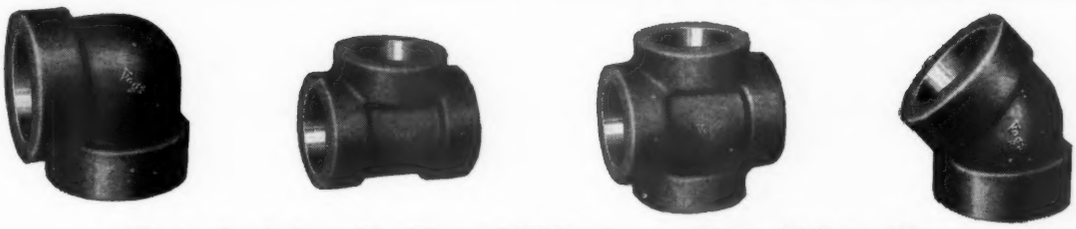

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Typical view of a classroom for instrument personnel training.

Trends in Refinery INSTRUMENTATION

Purpose of the instrument department and requirements for its proper functioning must be determined first

S. D. ROSS and J. PROCOPI

PART 2

WIDESPREAD use of industrial instruments in the modern refinery is so generally accepted as an integral part of process equipment that one no longer has to justify them by enumerating their production benefits. The instrument department, too, which was struggling for recognition little more than a decade ago, is today an established part of the refinery organization.

Newer trends in refinery instrumentation continually impose new responsibilities and functions upon the instrument department; and a progressive management must constantly evaluate such trends, altering the organization to obtain optimum benefits in all processing operations.

The first article in this series reviewed some of the newer trends in instrumentation—toward added use of graphic panels and miniature instruments, dial and scanning systems, direct product quality control, as well as servomechanism and computer techniques in system engineering. In this article, emphasis is placed upon the effects of such trends on the instrument department organization. Certain thoughts are directed not only at instrument personnel, many of whom are well aware of them, but also at refinery management who have authority to make organizational changes.

Background Data on Organization

In the past 10 years or so, progressive instrument men have devoted much thought and effort to the role of an instrument department, and to the educational and training needs of instrument personnel. The extensive list of references given at the end of this article is conclusive evidence of this fact. Those men charged with the responsibilities of organization and personnel in an instrument department can benefit greatly by a thorough study of such references and by bringing constructive ideas from them to the attention of their own management.

A number of the references, given contain detailed descriptions of specific department set-ups, as well as requirements and training courses for the various classes of personnel. Other articles listed are devoted to descriptions of shop layouts and physical equipment. Some contain what might be termed the "philosophy" behind instrument engineering and maintenance. The present article is devoted more to the latter type of material, but a cross-index table of all the references is included with breakdowns to indicate the main subject matter of the articles. In future articles of this series the authors plan to cover specific checking and calibration equipment, as well as special maintenance techniques dealing with particular classes of instruments and system components.

EXCLUSIVE

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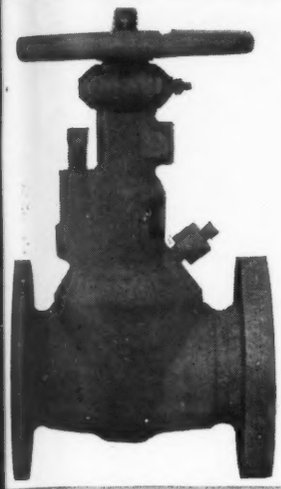
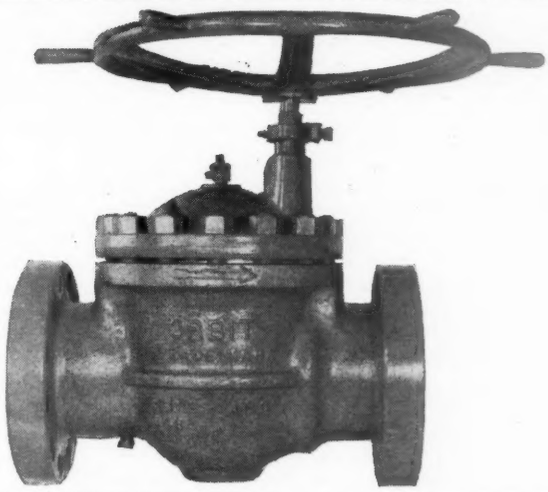


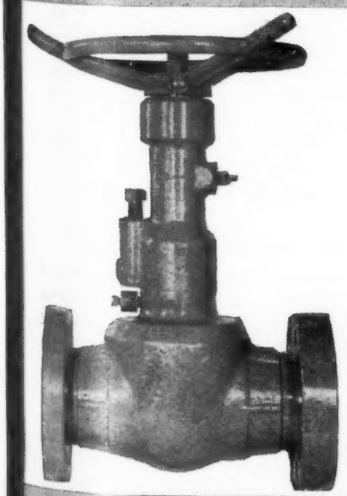
Orbit Forged Steel Valves have been designed with a friction free seating principle. To the operator this means longer service at lower maintenance costs because the absence of friction in seating means greatly reduced wear at the point of seat contact. It is not necessary to tighten Orbit Valves to the extreme to obtain positive closure, due to their unique seating principle. Since there is no contact between the seating core and the body, or the seating core and the body seat in the process of opening or closing, there is no rubbing or scuffing of the valve seating surfaces. The extreme ease of operation of Orbit Rising Stem Production Valves is due to this fact. Fluid loads acting on the valve seating core are applied to the trunnions, rather than on the spherical seating surfaces, thus reducing the frictional lever arm to a minimum, as well as the torque necessary to rotate the core. Orbit's friction free seating principle coupled with an exceptionally strong operating mechanism, both of which are contained in an all Forged Steel body and bonnet, is your assurance for dependable, trouble free service.

PRODUCTION SERVICE

For many years Orbit Drilling Valves have been used to control commercial gas wells and gas storage wells all over the United States, Canada and foreign countries. Thousands of them have been operated daily and have never been out of service. Orbit Drilling Valves have been chosen for these services because they afford low cost maintenance, easy operation and a positive dependable shut-off in all kinds of weather conditions. "Switching" operations can be quickly performed by one man when a lease is equipped with these easy operating valves. Orbit Drilling Valves are made in sizes 5½", 7", 8⅝" and 10¾", Screw End and Flanged End and Cross Type. All Orbit Drilling Valves are furnished equipped with handwheel that is detachable.



L. P. GAS SERVICE



The Orbit resilient, friction free seating principle is a natural for holding liquefied petroleum gases. Regardless of minor body deflections, contraction or expansion brought about by fluctuating temperatures or pressures, the Orbit seating principle is not affected. No lubricant of any kind is required in the valve body to effect a shut-off; therefore maintenance of Orbit L. P. Gas Valves requires a minimum of expense and attention. Orbit L. P. Gas Valves also feature an all forged steel body and bonnet plus welded bonnet construction and adjustable reliable plastic stem packing — This combination makes the Orbit L. P. Gas Valve the "last word" in safety and dependability. The use of Orbit L. P. Gas Valves is your assurance against fluid contamination. You can buy Orbit Valves with confidence because they are designed to handle your hard-to-hold hydrocarbons and vapors.

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Instrument trainees doing laboratory work in an instrument manufacturer's training school.

What Does Management Expect of the Instrument Department?

An answer to the above question, more than any other single factor, appears to be basic in determining the organization of a refinery instrument department. In earlier days, when a few temperature and pressure indicators were "hung" on the completed and operating process, neither the plant superintendent nor the operators attached much importance to these simple "gadgets". Operation of the refinery was almost entirely independent of instruments and their care was relegated to general plant maintenance work.

In contrast, today, refinery management has accepted readily the fact that its modern continuous processes would be practically inoperative without the accurate and dependable automatic controllers that monitor temperatures, pressures, flows, liquid levels, and other variables throughout the units. Because failure of any major instrument in the system can result in the loss of valuable production time, processing materials, and perhaps equipment, the plant superintendent has grown to respect his "robot operators" and the important job of his instrument department in seeing that the instruments continue to function properly.

Adequate care of existing instruments is then one fundamental task that management expects of its instrument department without question. And for this purpose, sufficient funds are doubtless provided for shop equipment and personnel. There may be some question, of course, as to what are considered "sufficient funds" unless there is a thorough understanding of the complexity of modern instrumentation and the need for adequately trained personnel to handle this job. The amount of "preventive maintenance" work on instruments and controls, for example, depends in large measure upon the available manpower in the refinery instrument department. Time spent on such work apparently varies in different refineries from well-planned routine assignments to none at all except during "turnarounds".

Is Instrument Work Confined to Maintenance?

Continuing on the question of what management expects of the instrument department, consider other possible duties and responsibilities that are not so obvious as routine maintenance work. It is this field of activity that needs to be brought more forcefully to management's attention in many refineries. Important functions in any refinery include:[T7]

(1) Proper selection of instruments to assure that measurement and control specifications are met, and with an eye toward minimum maintenance.

(2) Correct installation of instruments including their primary elements, piping and wiring, and control valves—to provide optimum results and minimum maintenance.

(3) Analysis of present instrumentation, from the viewpoints of process efficiency and maintenance, toward the end of recommending improvements.

(4) Keeping abreast of all new developments in the field of instrumentation which might be incorporated in present or planned processes as an aid to increase product quality, decrease wastes, etc.

(5) Development of instruments for particular measurement or control applications in the refinery, or modification of commercially available instruments to meet specialized requirements.

(6) Selection and training of personnel to do the various types of jobs in refinery operation.

Organization in different refineries varies greatly as to which department is responsible for such important functions. In many cases, this is because of the different sized plants, or because a group of plants has a centralized engineering department that handles the instrument specifications and possibly the research problems for all plants.

It does not appear essential that these functions be assigned to the instrument department, but they should certainly be assigned to individuals with the proper qualifications. Instrument engineers with "know how" attained from actual field experience are best suited for this type of work. Co-ordination of these functions in some suitable manner can not help but result in improved performance, increased process efficiency, and lowered maintenance costs.

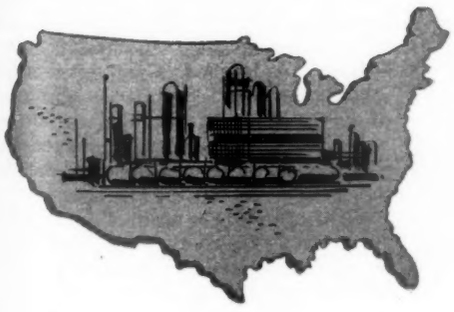
It is unfortunate that the lack of such coordination does not reveal itself in a more startling manner than simply the lack of such results that are not easy for the average instrument man to prove to his management. Perhaps a brief discussion of benefits to be obtained from these functions can emphasize their importance to management.

Proper Instrument Selection

Instrumentation has developed rapidly in the last decade and involves a much more complex array of possible equipment from which selections must be made for given measurement and control problems. Combined with modern continuous processing techniques with higher rates of throughput and decreased storage capacity, this presents an engineering problem that can be

A bank of ten Beaird pressure storage tanks in a Nebraska gasoline plant.

BEAIRD PRESSURE STORAGE TANKS



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solved properly only by a specialist—the instrument engineer. Whether this individual or a group of such individuals is a part of the instrument department, or part of another department, his contribution to ultimate operation of a process can not be overemphasized.

In terms of operating efficiency, proper selection of instruments provides benefits that are as basic as the advantages of instrumentation itself. If steady state flow conditions or close tolerances on temperature control are vital to product quality and require automatic control, it is not sufficient to recognize that some form of control is required, but rather a careful choice of controls must be made to meet the requirements. Control of outlet flow from a surge tank, based upon level in the tank, may for example require a well-engineered "averaging" control system in order that the outlet flow not have any sudden surges to upset the subsequent processing unit.

In terms of subsequent maintenance required, considered judgment in instrument selection is of equal importance. Sustained performance of a measurement and control system, not just initial performance, is the goal sought by the instrument engineer. Two methods of instrumentation may appear equally suited for the application, but experience has taught the instrument man that one is much more reliable for continuous operation with a minimum of maintenance. His advice in instrument selections can save valuable production time or processing materials that might otherwise be lost in maintenance or repair of poorly instrumented processes.

Correct Installation Vital

Even though the best available talent has been applied for proper instrument selection, all the resultant benefits can be nullified by slipshod procedures or ignorance of personnel assigned to installation of the instrumentation. All the sensitivity and accuracy of an electronic temperature controller, for example, is lost if its thermocouple is improperly inserted in a pipe or vessel for correct measurement. Similarly, clogged orifice connections will make the most modern pneumatic-balance, mercuryless flow meter sluggish in response and incapable of permitting close control of flow.

Here again, it is not so important as to whether this function is assigned to the instrument department, so long as it is supervised or handled by men who have a knowledge of the correct practices and the reasons for them. One instrument engineer made a very thorough study of this important function that was improperly handled[5]; his analysis of the attendant losses in man-hours and production time required to rectify the mistakes and omissions shows graphically the advantages of proper consideration of the installation phase.

View of instrument shop in typical processing plant.

Improving Present Operations

Even in a "going" refinery, management can ill afford to overlook the fact that its present instrumentation can be improved. New methods of measurement and control are constantly being marketed by a highly competitive instrument industry. Moreover, with even the best available talent involved in instrument selection, all the "bugs" of an actual installation cannot be foreseen.

Unless the instrument department, or a special group, is adequately staffed to do more than preventive or emergency maintenance work, many possible production benefits that might be derived from new or improved instrumentation must necessarily be lost for lack of attention. A new type of gas analyzer, for example, may permit continuous monitoring of product quality within closer tolerances that would pay real dividends in a short period of production.

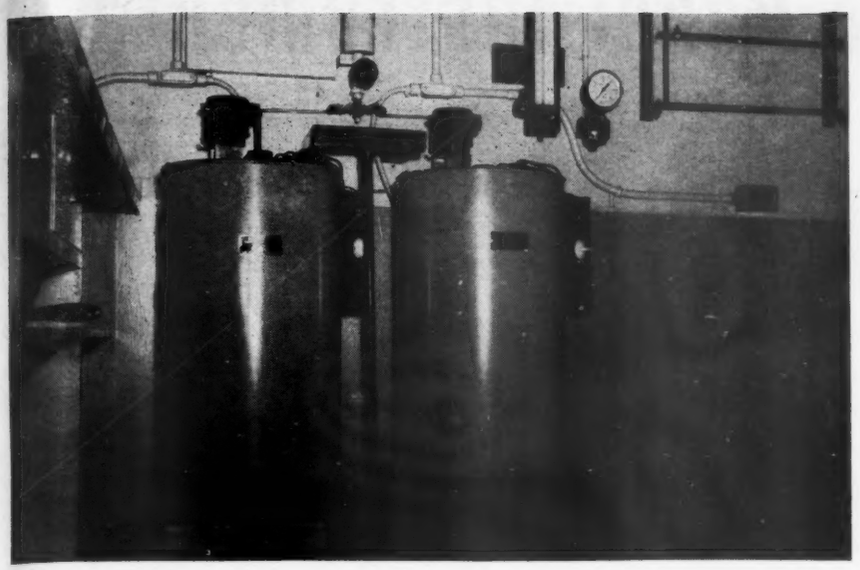
Improvements in process operations may also be achieved through less spectacular means than the addition of a new or novel instrument. Given the time and opportunity, a trained instrument man can often better the performance of a control installation by the simple procedure of changing the controller adjustments, or by recommending a valve positioner to provide positive and smooth action of a diaphragm motor valve. Or, upon the study of a flow meter installation that is frequently going out of service, he may find that the orifice connections are becoming plugged and that this condition can be eliminated by the installation of a purge system.

With some 3 per cent of the capital equipment of a refinery invested in instrumentation and with the cost of maintenance running about five per cent of this investment, management should need little incentive to encourage what might be termed "application research" toward the ends of increasing process efficiency and decreasing maintenance costs. The answer may well be the addition of one or two persons to the instrument department, or other group in the refinery for such work.

Personnel Selection and Training

Without further discussion of other functions of the instrument department

Shop storage for extra instruments.



Constant temperature baths.

or other departments in the refinery (such as, keeping abreast of new trends in instrumentation or special instrument development work), it should be obvious that the personnel requirements for such work in a modern refinery are much more exacting than they were 10 years ago. There still exists, of course, various jobs with varying degrees of specialization and training required, but the trend is toward a general higher level of education and intelligence in the instrument department.

All refinery men interested in instrumentation should be aware of current work being sponsored by the Instrument Society of America to aid industry in their training of instrument personnel. A sub-committee on instrument mechanic training, working under the ISA committee on maintenance and operations, has prepared a report on an "Industrial Instrument Training Course Outline", which is designed as a guide to instructors for instrument maintenance personnel.[T7] This report, which has been published recently by the I.S.A., not only provides a comprehensive outline of courses on all major instrumentation applied in the processing industries today, but also contains much valuable reference material, such as lists of (1) practical training courses offered by instrument manufacturers, (2) courses in instrumentation offered by educational institutions, (3) reference textbooks and other source material on basic physics, chemistry, and instrumentation for training programs, and (4) motion picture films useful for instrument training courses.

Also, on the engineering level, the ISA Committee of Education is considering a similar project for the purpose of developing a training course for instrument engineers. Petroleum refineries, one of the largest users of industrial instruments, will benefit greatly from the consolidation of such data and its use by their instrument personnel.

A. General References (Primarily Organization)

1. "Instrument Maintenance in an Oil Refinery" by V. H. Hiermeier, *Instruments* Vol. 17, April 1944, pp. 199-233.
2. "Socony-Vacuum Oil Company, Inc.-Paulsboro Refinery-Instrument Maintenance" by Alfred Krieg, Supervisor of Instrument Department, *Instrumentation* Vol. 1, No. 6 1945, pp. 27-30.
3. "Socony-Vacuum Oil Company, Inc.-Paulsboro Refinery-Instrument Maintenance" Part 2, by Alfred Krieg, Supervisor of Instrument Department, *Instrumentation* Vol. 2, No. 1, 1946, pp. 27-30.
4. "Selection, Application, and Maintenance of Refinery Instruments," by Alfred Krieg, *The Petroleum Engineer* Series of Eight Articles, 1946.
5. "Process Unit Control Instruments, Their Installation and Initial Operation" by H. F. Moore, *Instruments* Vol. 19, Oct. 1946, pp. 579-583.
6. "Organization of the Instrument Division at Canada's Synthetic Rubber Plant" by J. W. Graeb, *Instruments* Vol. 19, Nov. 1946, pp. 646-650.
7. "Shop and Equipment Requirements for an Instrument Dept. in a Large Process Plant," W. H. Fortney, *Instruments* Vol. 20, Feb. 1947, pp. 141-149.
8. "On Starting an Instrument Department" by M. F. Behar *Instruments* (Editorial) Vol. 20, March 1947, pp. 229-230. (Contains list of references articles on organization and shop equipment up to 1947.)
9. "Organization of a Research Laboratory Instrument Dept." by P. G. Exline, *Instruments* Vol. 20, May 1947 pp. 438-443.
10. "Organizing an Instrument Department" by C. S. Comstock and H. V. Fisher, *Chemical Engineering Progress*, Vol. 43, June 1947, pp. 303-308.
11. "Instrument Engineering in a Large Chemical Plant," by C. S. Comstock, *Instrumentation* Vol. 3, No. 1, 1947. pp. 28-30 (Based on paper presented at First Texas A & M College Instrument Course and similar to Reference 23).
12. "Functions of an Instrument Development Laboratory" by V. F. Hanson, *Chem. Engr. Progress* Vol. 43, No. 7, July 1947, pp. 379-382.
13. "The Functions and Responsibilities of a Plant Instrument Department" by J. G. Kerley, *Petroleum Refiner* Vol. 26, No. 9, Sept. 1947, pp. 98-104. (Presented at Second Annual Short Course on "Instrumentation for the Process Industries"—Texas A & M Aug. 27-29, 1947. (Also, *Instruments*—Vol. 20, Oct. 1947, pp. 914-918.)
14. "Instrument Maintenance" by H. A. Hulsberg *Petroleum Refiner* Vol. 27, No. 5 May 1948, pp. 111-113. (Also, *Chem. Engr. News* Vol. 26, No. 33, Aug. 16, 1948, pp. 2424-2426.
15. "Instrument Installation and Maintenance Practices in a Modern Refinery" by G. A. Larsen, *Instruments* Vol. 21, May 1948, pp. 440-442.
16. "Instrument Dept. Organization in a Large Chemical Plant" by Rollin H. Briggs, *Instrumentation* Vol. 3, No. 2, 1948, pp. 26-29.
17. "Organized Instrument Engineering" by J. Johnston, Jr., *Instruments* Vol. 22, August 1949, pp. 755-757.
18. "Plant Instrument Shop Testing Equipment" by H. V. Fisher, *Instruments* Vol. 22, September 1949, pp. 794-797.
19. "Typical Activities of a Specialized Instrument Section in a Chemical Company" by V. F. Hanson and D. D. Friel, *Chem. Eng. Progress*, Vol. 45, No. 7, July 1949, pp. 471-474.
20. "Organization of an Instrument Department" by W. H. Forney, *Instruments* Vol. 22, Nov. 1949, pp. 1001.
21. "Instrument Shop Tools" by F. S. Becker, *Instruments* Vol. 22, November 1949, pp. 1057-1058.
22. "A Centralized Organization for Instrument-Application Research" by J. G. Kerley, *Instruments* Vol. 22, December 1949, pp. 1098-1099.
23. "Instrument Shop Test Panel" by T. L. Clift, *Instrumentation* Vol. 4, No. 4, 1950, pp. 29-30. (For pressure and differential pressure gauges).
24. "The Instrument Department Grows Up" by R. F. Angell, R. Tobi. *The Petroleum Engineer* June 1951, pp. C-23 to C-26.
25. "On Starting an Instrument Department" by M. F. Behar *Instruments* Vol. 25, June 1952 (Repetition of March 1947 editorial—Reference 8—wtih list of reference articles up to April 1952).

B. References on Personnel Training

T1. "Problems in Obtaining Personnel in the Wartime Operation of an Instrument Department" by G. P. Bosomworth, *Instruments* Vol. 17, January 1944, pp. 10-11.
T2. "Training Instrument Men for the Government Magnesium and Styrene Plants" by R. W. Cermak, *Instruments* Vol. 17, January 1944, pp. 11-13.
T3. "Instrument Craftsmanship Training Course" by G. A. Larsen, *Instruments* Vol. 21, May 1948, pp. 436-438.
T4. "Instrument Personnel Training Program in a Modern Chemical Plant" by Rollin H. Briggs, *Instruments* Vol. 22, Dec. 1949, pp. 1146-1148.
T5. "Instrument Repairman Trade Apprentice Training Program" by J. H. Cuthbert, *Instruments* Vol. 23, March 1950, pp. 280-281.
T6. "Instrument Mechanic Training" by R. Johnson, *Instruments* Vol. 23, March 1950, pp. 281-283.
T7. "Industrial Instrument Training Course Outline" I. S. A. Report published in June 1952.

C. References on University Courses*

C1. Series of Papers from Conference on "Instrumentation and the University", Carnegie Institute of Technology, published in *Instruments*, Vol. 18, November 1945.
C2. "The Development of Instrument Curricula" by M. B. Hall, *Instruments* Vol. 22, August 1949, pp. 752-754.
C3. "Purdue's Course in Engineering Instrumentation in the School of Chemical and Metallurgical Engineering" by G. W. Sherman, *Instruments* Vol. 23, January 1950, pp. 31-33.
C4. "Concepts of Instrumentation as Taught at the University of Tennessee" by P. E. Wald, *Instruments* Vol. 23, July 1950, pp. 670-674.
C5. "The Instrumentation Course at Pratt Institute" by E. P. Lamb, *Instruments* Vol. 23, July 1950, pp. 670-674.

*ISA Report (Reference T7) contains a list of universities offering courses in instrumentation.

* * *

Part 3 will be published soon.

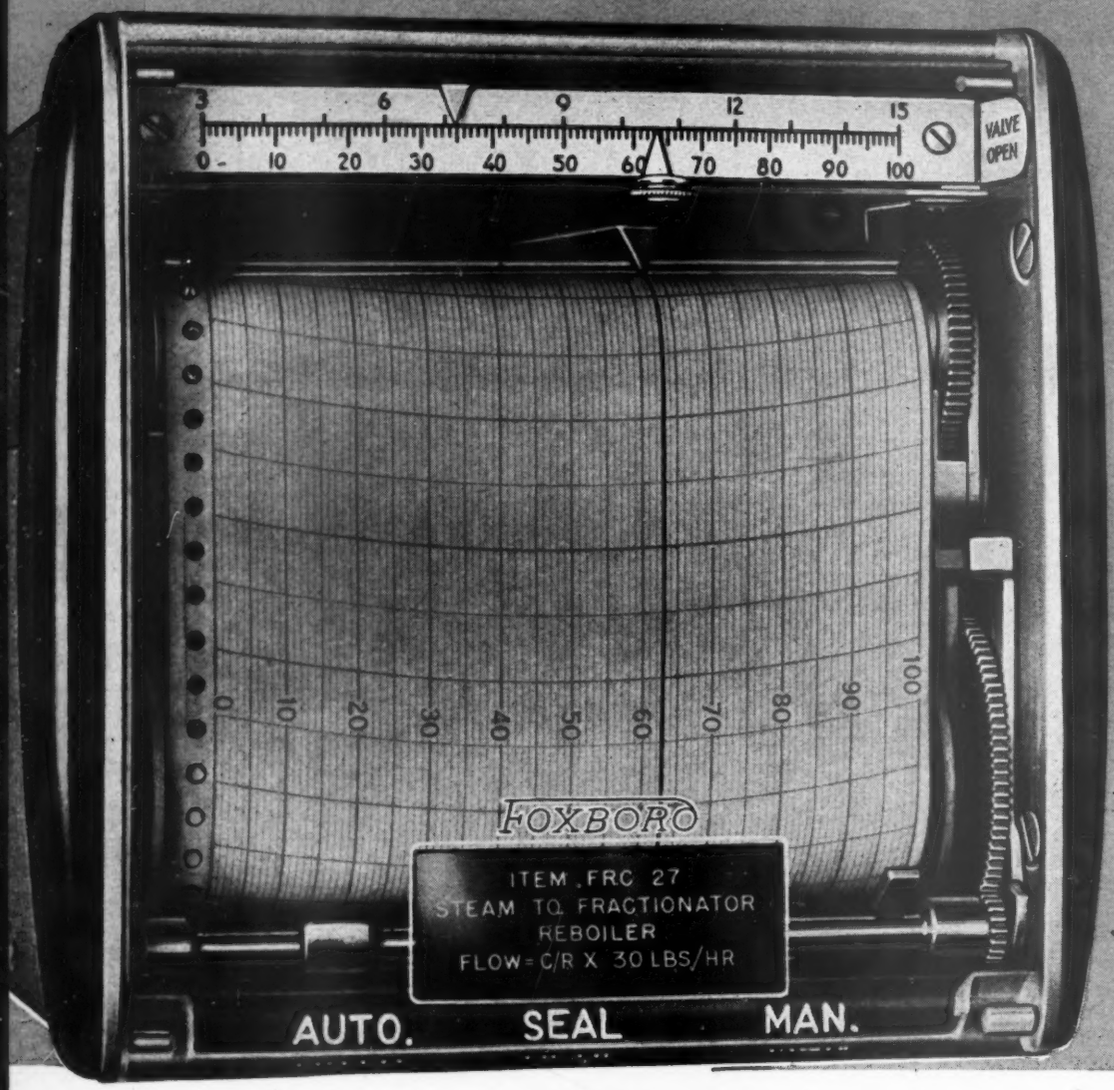
TABLE 1. Cross-index of references.

Subject	Reference Numbers (See Bibliography)
Organization	1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12*, 13, 14, 16
Shop Equipment and Layout	1, 2, 4, 6, 7, 15, 18, 19*, 21, 23
Personnel Requirements and Training	1, 2, 3, 6, 14, 16, T1-T7 inclusive
General on Instrument Maintenance (including some "philosophy")	8, 10, 11, 13, 14, 17, 25
University Courses	T7, C1-C5 inclusive

*Articles deal with an instrument development laboratory or department rather than with an instrument shop.

Graphic Panel Instrumentation

CONSO



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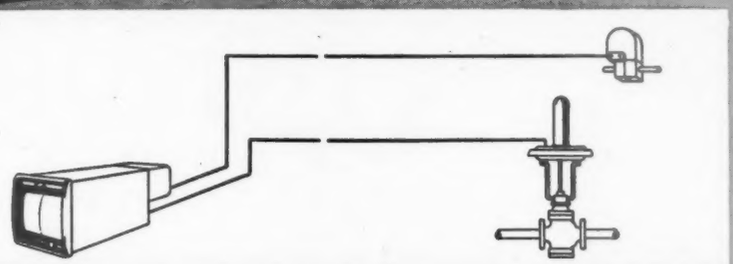
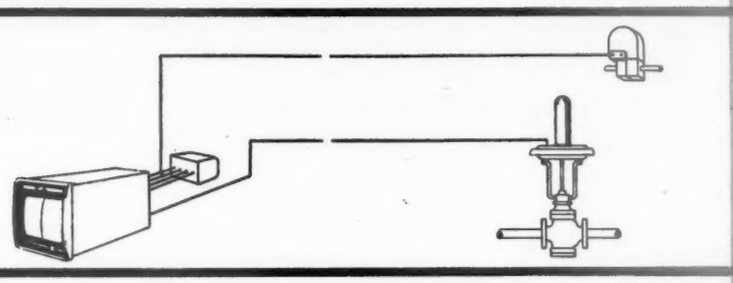
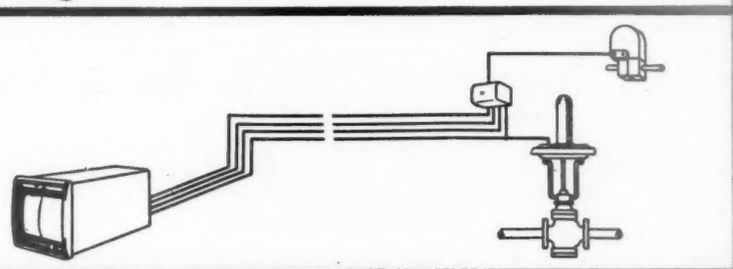


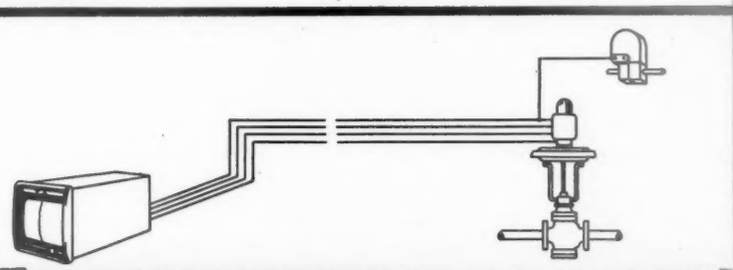
2 **Consotrol Recorder with M/58 Consotrol Controller... rack-mounted**



3 **Consotrol Recorder with M/58 Consotrol Controller... field-mounted**



4 **Consotrol Recorder with valve-mounted M/59 Consotrol Controller.**



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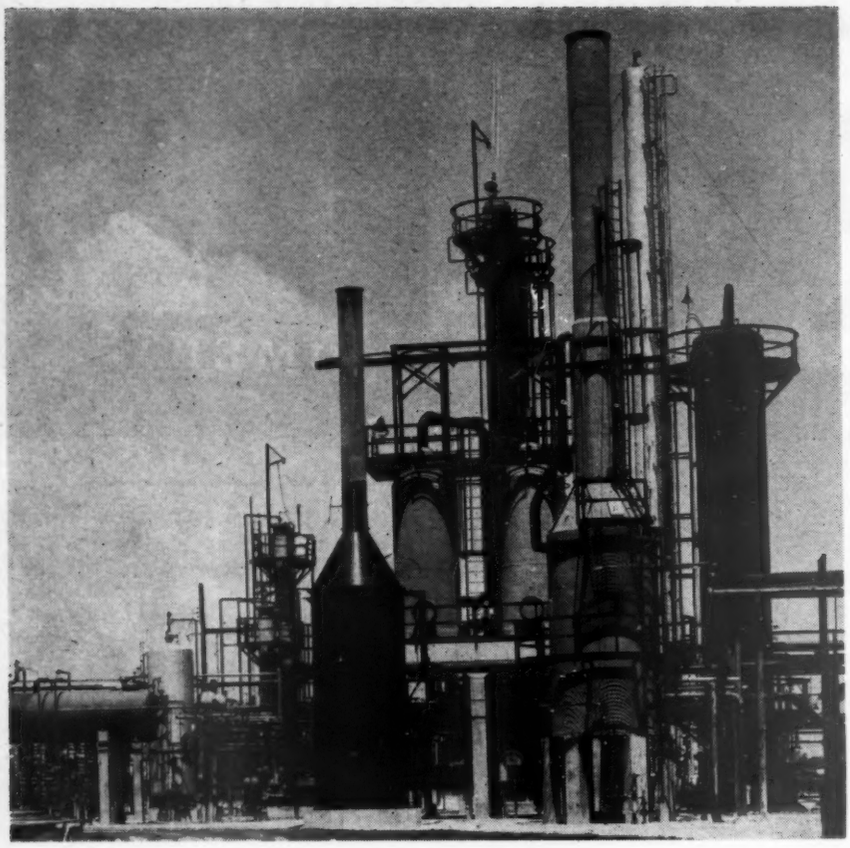

FIG. 1. General view Peppers Refining cycloversion unit.

Cycloversion, Poly Units Improve Refiners' Marketing Position

E. M. BEEBE*

PEPPERS Refining Company, situated in the highly competitive gasoline marketing area of Oklahoma City, Oklahoma, was confronted with the problem of augmenting its plant with facilities sufficiently modern to meet the gasoline quality demanded. Refining facilities consisted of combination crude topping-thermal cracking and sweetening units. The important factor considered was that any new equipment to be installed, in addition to upgrading gasoline stocks, should be sufficiently flexible to meet seasonal fluctuations in product sales. This, of course, required a unit that could process charge stocks which varied considerably in their characteristics.

Accordingly, the modernization plan was resolved by the installation of a Perco cycloversion unit and a catalytic polymerization unit. Perco cycloversion was selected due to its flexibility and low operating and construction costs. With the cycloversion unit, charge stocks can be varied from gasoline boiling range material, processed at desulfurization or reforming conditions, to gas oil that can be catalytically cracked. Each of these operations can be performed in this equipment because the same catalyst is used, the limitation being only the regeneration facilities provided. The cycloversion unit when operated under reforming conditions permits the inclusion of a large front end portion of the kerosine fraction that alleviates a problem during the summer months when the market situation for this product is not favorable. Catalytic polymerization complemented the modernization program as the gases made from the cycloversion unit operation are rich in olefins. These gases, as well as those from the thermal cracker, are polymerized to yield a high octane number blending component instead of being burned as fuel gas.

The 1000-bbl per day cycloversion unit and the 100 bbl per day catalytic polymerization unit were designed by Koch Engineering Company of Wichita, Kansas. All construction work was done by Peppers personnel without interrupting other plant operations. It was possible to effect considerable economy by the utilization of a sizable amount of existing equipment in the plant modernization program.

The cycloversion unit consists of two reactors that permit continuous operation, i.e., one reactor is on process while the other is being regenerated. Also included are fractionation and stabilization facilities. The unit was placed in operation in June 1951, and has processed straight run gasoline and cracked naphtha in blocked operation as well as various mixtures of the cracked and straight run naphthas in combined operation. At present cracked and straight run naphthas are being processed in blocked operation. This latter type of operation was resorted to because a better yield-octane relationship is realized when desulfurizing the cracked naphtha and reforming the straight run naphtha separately and blending the two products to make base stock for both the premium and regular grade gasolines.

When processing straight run gasoline, operating conditions are generally somewhat more severe than when processing a cracked gasoline. The reason for this being that a straight run gasoline charge is usually processed at the reforming level under which conditions two reactions, desulfurization and reforming, are accomplished. A cracked naphtha is generally processed at less severe conditions that effect desulfurization of the stock. Higher temperature levels tend to promote excessive carbon deposition on the catalyst when cracked naphthas are treated. A combined feed of straight run and cracked naphthas is generally processed at operating conditions intermediate to the reforming or desulfurization operations.

Fig. 1 is a general view of the complete unit and Fig. 2 is a simplified flow diagram of the unit. At extreme left of Fig. 1 can be seen the elevated horizontal feed surge tank. This surge drum is provided so that straight run gasoline and cracked naphtha can be run simultaneously into it from the crude topping and thermal cracking units. The Perco unit charge pump takes suction on this tank. Such a processing scheme permits charging an essentially oxygen-free stock thereby minimizing low temperature carbonization of heat exchange equipment. To the right and in back of the surge drum is the fractionator overhead accumulator, which in addition to supplying reflux to the fractionating column also serves as charge tank for the stabilizer. Just to the right of this accumulator can be seen the feed preparation facilities for the cat poly unit which handles olefinic gases from the Perco unit and the thermal cracker. In the center foreground is the steam superheater which furnishes the diluent for the air used in regeneration of the catalyst. Regeneration temperatures are

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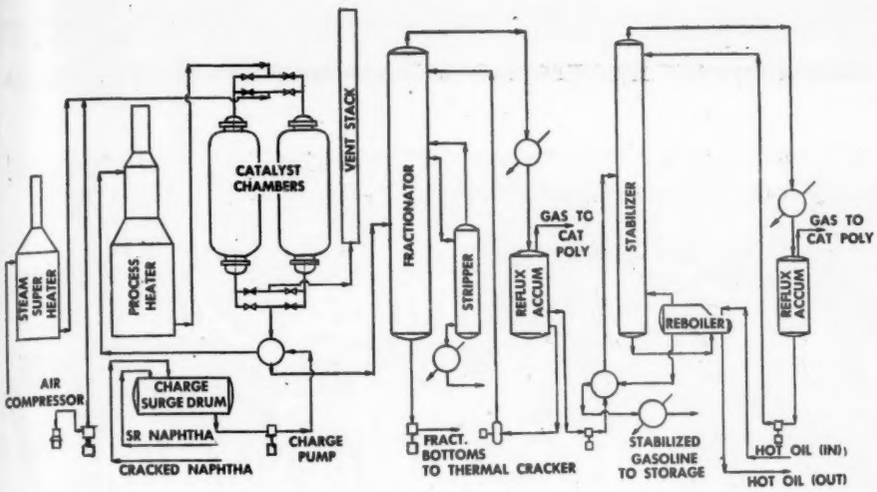

FIG. 2. Flow diagram cycloversion unit, Peppers Refining Company.

TABLE 1. Perco catalytic reforming of straight run gasoline.

Run:	1	2	3
Operating Conditions			
Charge, B/D	657	1084	815
Cat. inlet temp. F	950	960	975
Cat. chamb. press., Psig	50	63	60
Gas make, cu ft/bbl	115	118	121
Recovery			
Gasoline, Vol % of chg	95.5	70.4	94.2
Naphtha, Vol % of chg	0	22.6	1.8
Fract. Btsm, Vol % of chg	0	1.7	0
Gas and loss, Wt % of chg	4.5	5.3	4.0

		Product			Product		Frac.		Product	
	Chg.	Gaso.	Nap.	Chg.	Gaso.	Nap.	Btms.	Chg.	Gaso.	Nap.
Product Inspection										
Gravity API at 60 F	62.9	61.7		60.4	64.4	51.5	34.4	64.9	65.0	51.8
RVP at 100 F	8.4	6.5		5.5	10.7	0		9.3	7.8	0
ASTM Distillation, F										
Initial B.P.	115	114		116	95	184	194	94	95	154
10% evaporated	168	160		172	164	272	345	150	143	246
30% evaporated	208	208		224	216	310	380	196	190	290
50% evaporated	238	236		253	248	335	410	224	223	318
70% evaporated	267	266		264	283	354	444	258	252	341
90% evaporated	312	322		350	305	380	598	306	295	371
End point	376	378		410	364	428	748	368	340	442
Rec. Vol %	99	95		99	95	99	97	99	97	99
Research Oct. No's.										
Clear	49.8	60.1		46.8	59.5	39.0		53.8	61.0	45.0
+ 1 ml TEL per gal	62.6	70.4		58.5	69.0	—		65.9	71.8	54.2
+ 3 ml TEL per gal	74.5	80.2		71.7	79.4	—		75.8	81.9	68.2

TABLE 2. Perco catalytic desulfurization of cracked gasoline.

Run:	1	2	3
Operating Conditions			
Charge, B/D	784	818	840
Cat. inlet temp., F	810	855	870
Cat. chamb. press., Psig	75	55	58
Gas make, cu ft/bbl	41	50	66
Recovery			
Gasoline, Vol % of chg	98.3	75.1	80.7
Naphtha, Vol % of chg	0	23.0	17.4
Fractionator Btms, Vol % of chg	0.6	0	0
Gas and loss, Wt % of chg	1.1	1.9	1.9

					Product			Product	
	Chg.	Prod. Gaso.	Frac. Btms.	Chg.	Gaso.	Nap.	Chg.	Gaso.	Nap.
Product inspection									
Gravity API at 60 F	58.4	58.6	31.4	60.2	62.8	44.5	60.5	64.1	43.0
RVP at 100 F	5.7	7.4		8.6	8.5	—	—	10.3	—
ASTM Distillation, F									
Initial B.P.	116	98	190	100	87	190	94	95	167
10% evaporated	156	148	311	142	116	288	136	128	278
30% evaporated	221	207	366	208	174	338	200	174	330
50% evaporated	265	252	417	260	218	358	253	224	353
70% evaporated	302	298	475	308	271	360	297	266	374
90% evaporated	346	341	600	360	324	380	345	316	408
End point	370	398		396	365	416	380	350	514
Rec. Vol % Cracks at	—	—	696	97	98	99	99	99	99
Research Octane No's.									
Clear	71.0	72.6		71.0	74.6	62.0	73.2	77.0	69.5
+ 1 ml TEL/gal	79.1	81.5		79.4	83.6	70.7	81.0	85.6	75.2
+ 3 ml TEL/gal	85.6	87.4		85.2	88.3	77.8	85.5	90.4	82.0

controlled at the desired level by varying the air-steam ratio. To the right of the superheater is the process heater. Between these heaters the two reactor chambers can be seen and the stabilizer is shown behind them. It will be noted that the reactors are mounted high off the ground with the charge-catalyst chamber effluent exchangers placed under them. This arrangement effects a considerable economy of ground area. The Perco fractionator, not shown in the photograph, has a side stripper which takes a cut from the tray located about half way between the feed tray and the top of the column. This cut is shown as naphtha in processing results Table 1.

Table 1 shows operating data and inspection tests on charge and product when processing straight run gasoline. Data are given for reforming this gasoline when operating at three different catalyst chamber inlet temperatures.

Runs 1, 2, and 3 represent mild reforming of the straight run gasoline. Gas make offers a very convenient means of predicting product octane numbers once a few runs have been made. Of course, the gas-make product-octane number correlation can be made only on a given charge. When the charge stock characteristics change it is necessary to establish a new correlation. Gases produced by catalytic reforming are rich in olefins and are charged to the feed preparation section of the catalytic polymerization unit. In Run 1 no side cut was taken nor were any fractionator bottoms made. Runs 2 and 3 show that a side cut naphtha was taken. This naphtha is used as a blending component in making regular gasoline. The fractionator overhead gasoline is blended with the overhead product from the cracked naphtha operation to make the basic premium gasoline stock. Fractionator bottoms shown in Run 2 are charged to the thermal cracking unit.

Table 2 gives operating data and inspection tests on charge and product when processing cracked gasoline. Data are given for three different temperature levels for operating on this type charge. Again it is to be noted that results are shown with and without a naphtha side cut being taken from the Perco fractionator.

The side cut naphtha is used in the regular gasoline blend. In no case is the yield of product less than 97 per cent based on the charge and, as in the previous operation given in Table 1, the olefins in the off gases are recovered as poly gasoline. Fractionator bottoms, representing not more than 20 bbl a day are disposed of as thermal cracker feed. Though no data have been presented for processing a wider boiling range cut, i.e., one that would contain the lighter portion of the kerosine fraction, such an operation is economically feasible and will no doubt be utilized during the slow market period for this product.

With the completion of this modernization program Peppers Refining Company has achieved an improved marketing position with minimum added investment and operating expenses. * *

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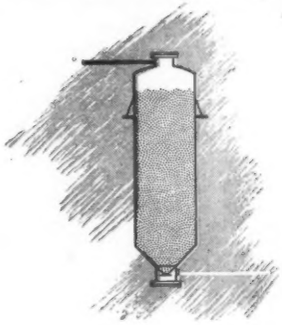

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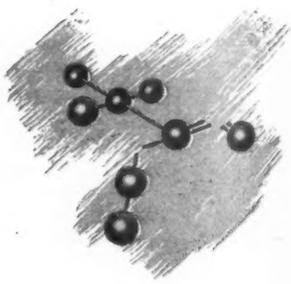

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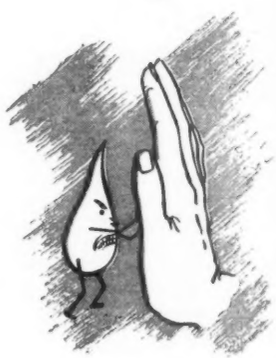

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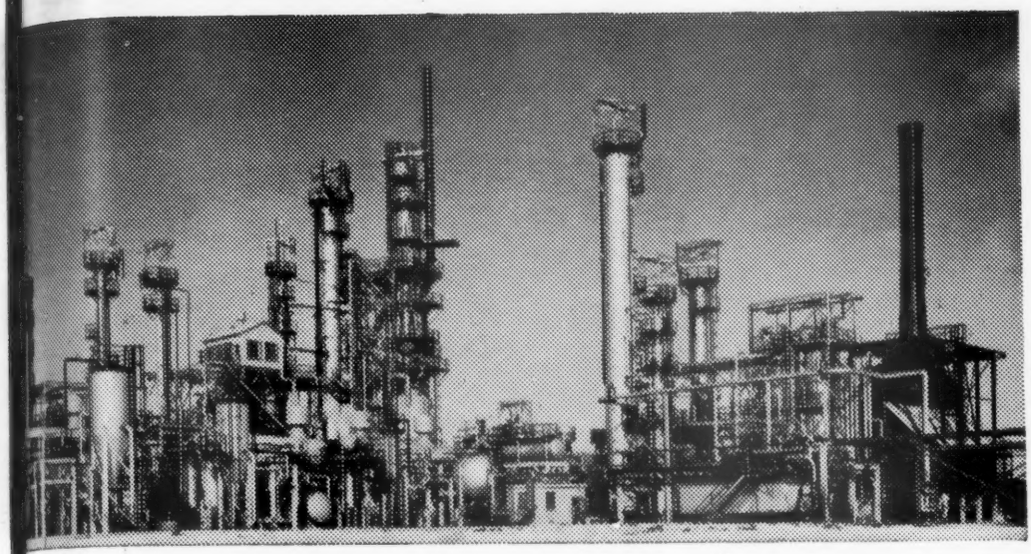


McColl-Frontenac's new Edmonton refinery forms a spectacular skyline on the outskirts of Alberta's capital.

Alberta's Biggest Cat Cracker Opens

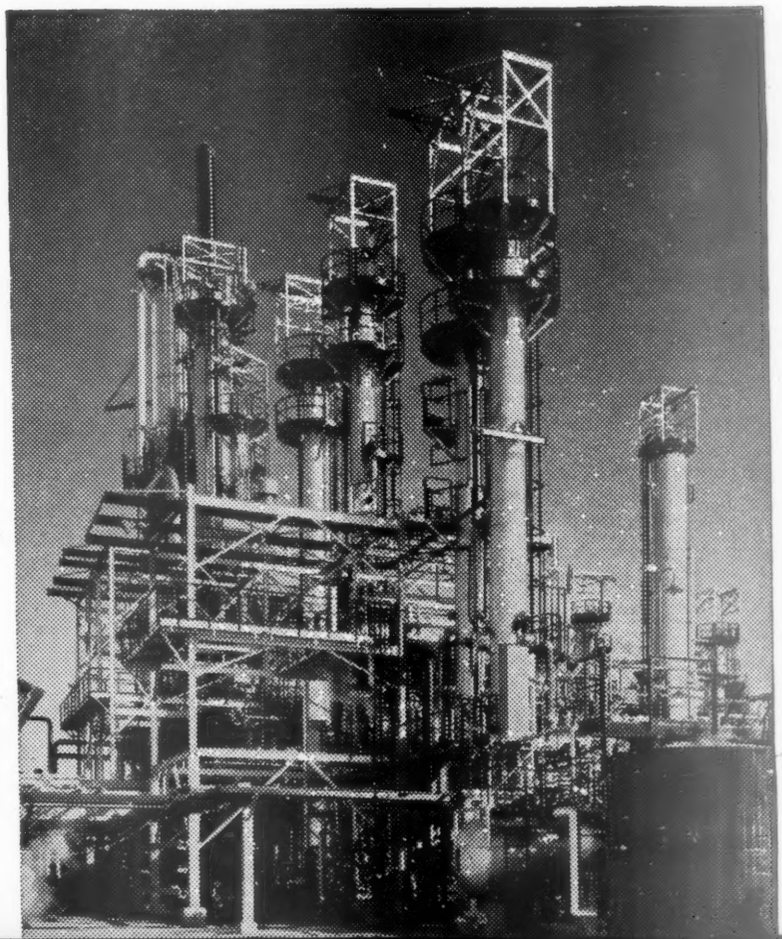
Official ceremonies at Edmonton Works of McColl-Frontenac attended by government and industry leaders

HARRY CHAPIN PLUMMER

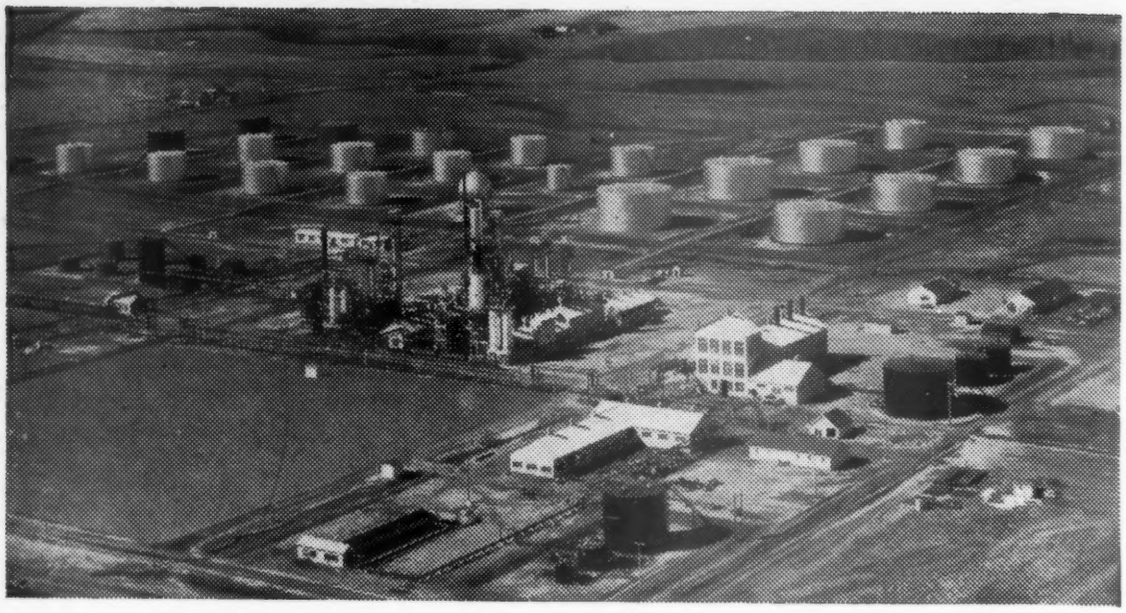
EXCLUSIVE

HALF a thousand guests, representing government and industry, attended the official opening, in mid-June, of Edmonton Works, the new western petroleum refinery of McColl-Frontenac Oil Company, Ltd. Welcoming address by A. G. Farquharson, vice president in charge of refining, was responded to by Honorable James A. McKinnon, senator from Alberta, and Honorable N. E. Tanner, Minister of Lands and Forests and Minister of Mines and Minerals of that province.

McColl-Frontenac officers and directors, headed by T. C. Twyman, president and chief executive officer, and a delegation of officers and executives of The Texas Company, with which McColl-Frontenac is affiliated and including H. T. Klein, M. Halpern, J. T. Wood, and J. W. Foley, were among those attending the ceremonies. For the first time in the company's history a meeting of the McColl-Frontenac directorate was held at Edmonton preceding the open-



Close-up picture of the fractionating towers indicate the complex structure of McColl-Frontenac's new Edmonton Works.



Aerial view of McColl-Frontenac's new Edmonton refinery reveals the wide area covered by the new installation. Tanks in the background have a storage capacity of 750,000 bbl.

ing. The head office at Montreal is the usual scene of those sessions.

Site of Approximately 160 Acres

The new refinery, completed late last year which has been operating since October, covers an area of approximately 160 acres. It has a daily crude oil capacity of 5500 bbl and is a major producer of high quality motor gasolines and such petroleum products as stove-oil, diesel fuel, and heating oils. It is equipped also for the specialized manufacture of heavy fuel oil and petroleum coke for industrial use; the daily production of the last-named item is about 60 tons. The normal operating staff consists of 150 employees of all classifications.

The refinery boasts the largest fluid catalytic cracking unit in Alberta and in addition to that towering structure it includes equipment for desalting crude oil, crude distillation, coking, catalytic polymerization, and product treating.

Crude From Wizard Lake, Leduc, Redwater

Originally designed to process oils from the Leduc and Redwater fields, the "Edmonton Works" is now being supplied by crude from the Wizard Lake area, discovered and developed by the Texaco Exploration Company, rated as a major crude find in Alberta in 1951, in which promotion McColl-Frontenac has a 10 per cent interest.

The catalytic cracking unit is the most advanced and efficient petroleum equipment, as it produces higher yields of high octane gas per barrel of crude than other processes. It is charged with the gas oils produced on the crude stilling and cooking units at the rate of 2640 bbl per day, say company officials. The combined weight of the reactor and regenerator vessels is 266,000 lb.

Gas oil is cracked in the reactor in the presence of catalyst. Carbon deposited on the synthetic fluidized clay, as the result of the cracking, is burned off in the regenerator, producing the essential heat. Carbon thus burned off is equivalent to 45 tons per day of the highest quality coal. The tremendous degree of heat liberated in the regenerator is transferred to the reactor by the flowing catalyst.

Petroleum Coke Daily Yield 60 Tons

Additional high quality gasoline is produced from the catalytic polymerization unit, where light gases resulting from the cracking of heavy oils are chemically combined to yield exceptionally high octane motor-fuel.

The coking unit processes reduce crude from the distillation unit to yield gas, cracked gasoline, heavy gas oil, and petroleum coke. Heavy gas oil is charged to the cat cracker. The daily production of petroleum coke runs approximately 60 tons.

Sweetening Third Catalytic Operation

Unwanted obnoxious and deleterious substances produced from the operating units are rendered harmless or removed by the treating and sweetening process; a catalytic sweetening process being employed. It is the third catalytic operation in the refinery, the other two being cat cracking and catalytic polymerization.

Edmonton Works is provided with a railway tank-car loading rack, which accommodates 22 cars at one time. It is possible to load gasoline at all positions on both sides of the rack and other fluid products at a sufficient number of spots to take care of required shipments. The coke produced in the continuous coking operation is loaded into hopper gondola cars by use of a conveyor system adjacent to the coke-drums. Truck loading facilities sufficient to handle all tank truck requirements are under construction. Modern barrel-filling and handling equipment also is being installed to facilitate shipments in barrels.

163 Miles of Process and Transfer Pipe

Into the construction of Edmonton Works went 8100 tons of fabricated steel, 8000 sq yd of concrete, 163 miles of process and transfer piping ranging from ¼-in. to 16-in. in size and necessitating approximately 12,900 valves in corresponding sizes. Four thousand drawings were prepared for the process equipment.

The storage capacity is upward of 27,000,000 gal. The water reservoir has 2,250,000-gal capacity. Steam requirements for the refinery are provided by three boilers, each with a rated capacity of 35,000 lb steam per hour at 250 psi. Electric power is purchased, three 250 KVA transformers being required to handle the load and reduce the 23,000-v transmission line power—for distribution throughout the refinery. Cooling water is pumped from the North Saskatchewan River; process equipment requiring 5500 gal per minute.

The engineering designer was The Texas Company, Foster-Wheeler, Ltd., the refinery contractors for off-site units, and the Burns and Dutton Concrete Construction Company for off-site facilities.

* * *

Farm Chemicals' Future

At present, only one-eighth of our crop land is cultivated with the aid of chemicals. That leaves seven-eighths of our crop land not being utilized to the fullest. Oil companies are testing many chemicals for better use on farm land.

NGAA Fractional Analysis Program†

Results show mean deviation from the true value of 0.55 to 1.04 mole per cent

A. J. MILLER*

THE importance of low temperature fractional analysis to the engineering, operating, accounting, and other phases of the natural gasoline industry has been oft-repeated. The trend towards larger and more complex operations, partnership involvements, sale of unfractionated liquid products, and separation of special components are some of the factors contributing to the growing financial significance of this analytical method.

The term "fractional analysis" or more popular expression "Pod analysis," is used from habit deep-rooted in the industry, where it has proved to be an essential tool since pioneer days. Despite its recognized shortcomings, it remains the best method available for many requirements.

In recognition of these facts, it has been the objective of the NGAA fractional analysis program to evaluate the errors prevailing in this analytical method on an industry-wide basis and to foster attention towards their causes and corrections.

Liquid Analysis Program

In 1950 approximately 300 analytical results from 60 laboratories were correlated. These results were on three liquid hydrocarbon mixtures blended to known compositions from high purity hydrocarbons by the special products division of Phillips Petroleum Company. Liquid samples were chosen because of their availability. The deviations in results, although less wide-spread than those obtained in the gas analysis program, indicated the need for further overall improvement.

A seminar on low temperature distillation was held in March 1951 with representatives from the laboratories for the purpose of discussing the common causes and cures of analytical errors. Recognized experts were obtained to speak and answer questions. Human element topics such as personal qualifications and morale, were included as well as the techniques and equipment involved. For good measure a topic was included comparing the infrared and mass spectrometer with fractional analysis.

Subsequently, two more hydrocarbon mixtures have been analyzed. Mixture number four is a mixed butanes sample, containing small amounts of propane and iso-pentane. It is the same type sample as mixture number two, and enables an overall comparison of accuracies prevailing before and after the seminar.

Mixture number five simulates a sample of deethanized natural gasoline and enables the determination of accuracy data on 26-70, excess butanes, and propane factors that are calculated from frac-

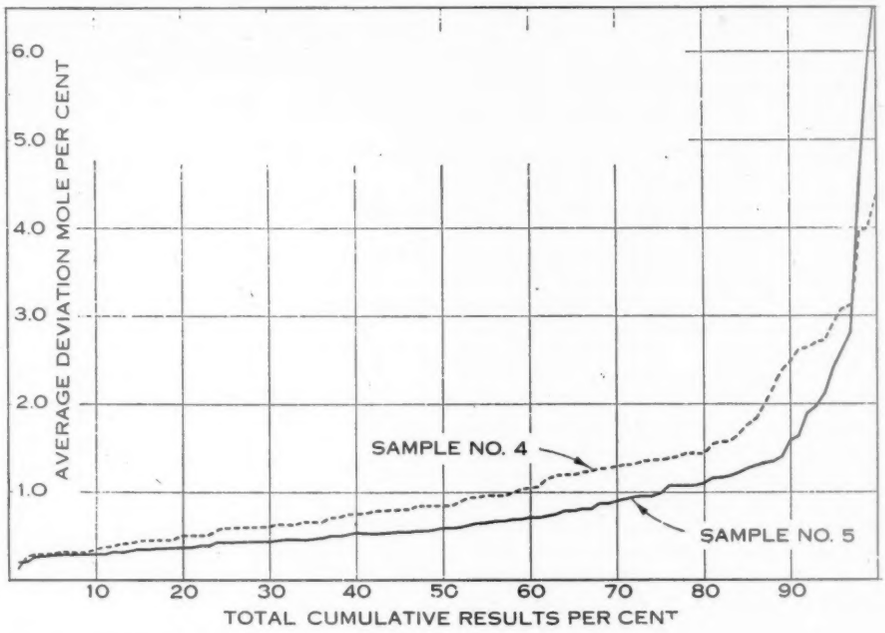


FIG. 1. Average deviation of all components from true values for NGAA samples No. 4 and No. 5.

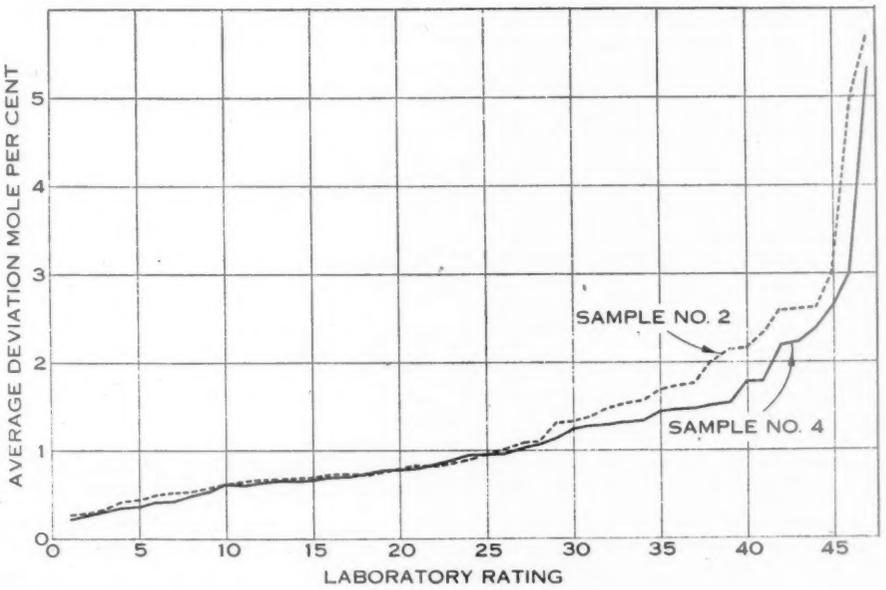


FIG. 2. Comparison of average deviations by laboratories reporting results on NGAA samples No. 2 and No. 4.

†Presented before NGAA, Houston, April 30-May 2, 1952, under program title "They Still Make Mistakes."

*Phillips Petroleum Company.

TABLE 1. Data on NGAA Sample No. 4.

Component	Synthesis Composition Mole %	Best Result Mole %	Mean Result Mole %	Mean Result Dev.
Propane	0.80	0.78	0.43	.37
Iso-butane	20.72	20.46	19.43	1.29
N-butane	77.68	77.87	79.02	1.34
Iso-pentane	0.80	0.89	1.12	.32
Total	100.00	100.00	100.00	3.32
Average Deviation		0.14		0.83

TABLE 2. Data on NGAA Sample No. 5.

Component	Synthesis Composition Mole %	Best Result Mole %	Mean Result Mole %	Mean Result Dev.
Propane	12.98	12.52	11.90	1.08
Iso-butane	8.17	8.22	7.73	.44
N-butane	33.84	33.98	34.76	.92
Iso-pentane	13.00	13.18	12.76	.24
N-pentane	18.01	17.95	18.60	.59
Hexanes plus	14.00	14.15	14.25	.25
Total	100.00	100.00	100.00	3.52
Average Deviation		0.17		0.59

tional analyses and frequently used for production allocations, sales, and exchanges.

Tables 1 and 2 present the synthesis compositions of samples number four and number five in comparison with the best and mean of results received. This represents the range of errors in the best half of all results submitted. The entire range may be observed in Fig. 1, where the average deviations are plotted in increasing order.

Fig. 2 indicates the overall improvement made by the laboratories after studying their errors on the first three samples. Only results of the laboratories that analyzed both samples number two and number four are included in this group comparison. Deviations are plotted in increasing orders on both samples. The comparison by individual laboratories is exhibited in Fig. 3, where the results on both samples are plotted by individual laboratories arranged in order of their deviation ratings on sample number two. As found in earlier correlations, few laboratories were consistent in their deviation ratings. There was noteworthy improvement by some laboratories, particularly those with unsatisfactory previous ratings, while some with better previous ratings lost ground.

Figs. 4 through 7 exhibit the magnitude of errors for some of the components. Each dot appearing on the charts represents a reported analytical value. As was the case for the first three samples, the reported values for the lowest boiling component were predominately below actual. The magnitude and predominance of the low values, however, were not as marked as in the earlier three samples. Definite improvement has been made as the result of holdup corrections which were discussed at the seminar. About 60 per cent of the laboratories attempted to apply these corrections. The lightest component in sample four, propane, was present in the amount of 0.80 mole per cent. The average of values reported for this component by laboratories making holdup corrections was 0.55 as compared to 0.43 for the others.

TABLE 3. Variation in 26-70, excess butanes, and propane factors.

Laboratory Code No.	Average Dev. of Analysis	Liquid Volume Per Cent 26-70	Excess Butanes	Propane
Tru Value	0.00	73.81	15.74	10.45
20	0.17	73.69	16.24	10.07
25	0.57	75.30	13.35	9.35
18	0.59	74.24	16.20	9.56
27	0.59	72.53	17.11	10.36
11	0.60	69.98	19.58	10.44

Continued effort toward overcoming holdup error is a proved need. Consideration of the consistent effect of this error on analyses emphasizes the importance of its correction.

Table 3 is offered to show the variation in 26-70, excess butanes, and pro-

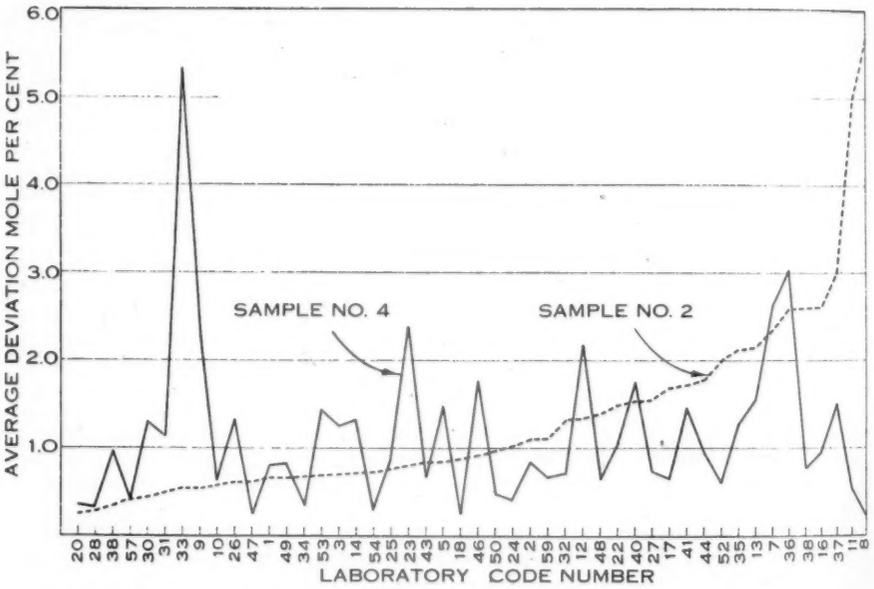


FIG. 3. Comparison of average deviations by laboratories reporting results on NGAA samples No. 2 and No. 4.

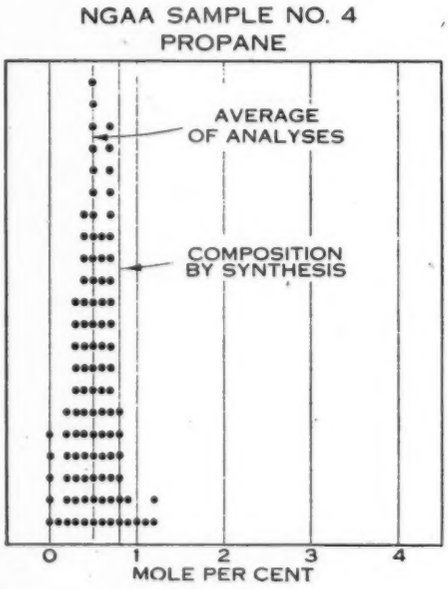


FIG. 4. Frequency distribution plot 0.1 mole per cent interval.

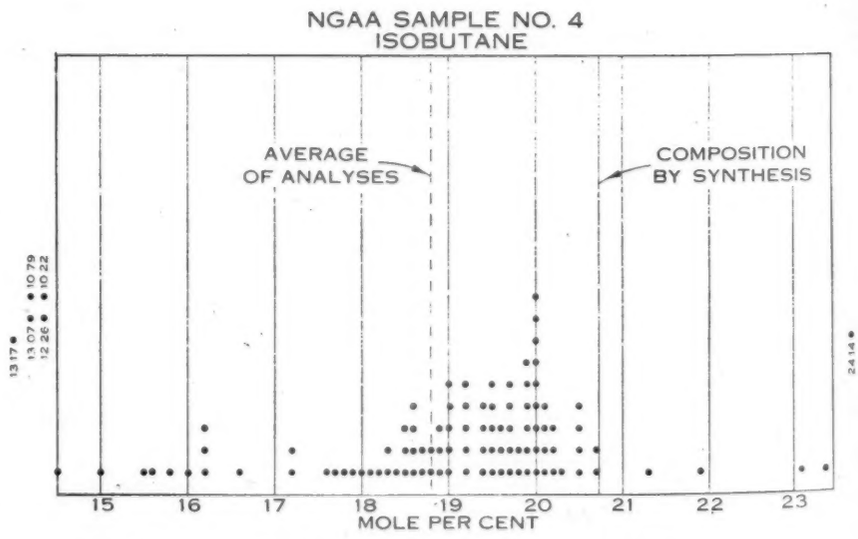


FIG. 5. Frequency distribution plot 0.1 mole per cent interval.

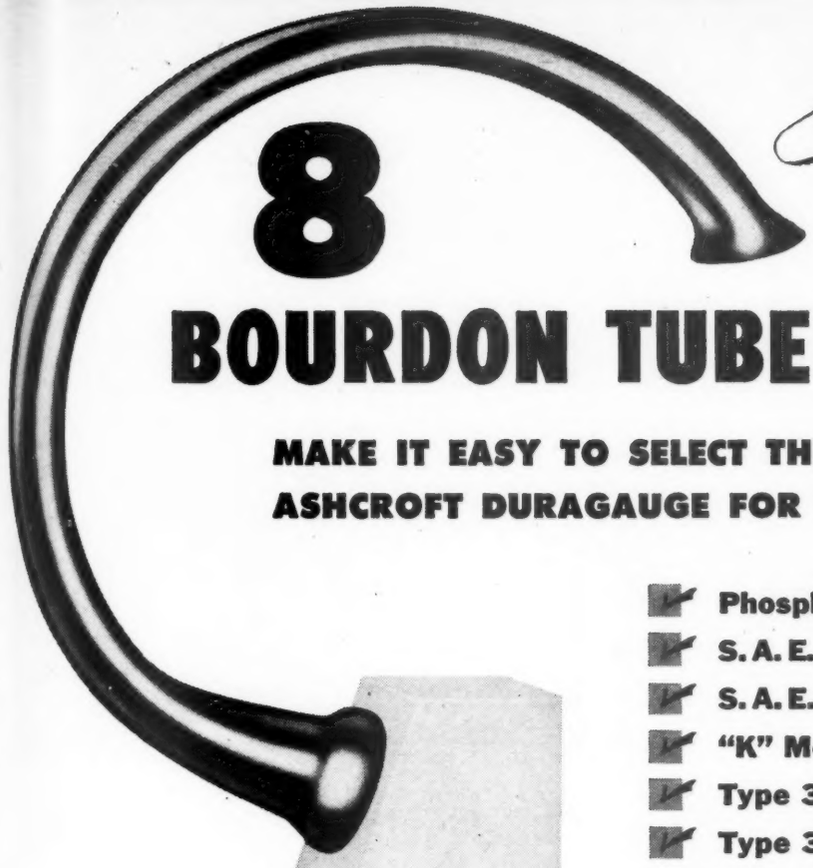


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TABLE 4. Comparison of lowest error with highest error results NGAA Hydrocarbon Mixture No. 5.

Laboratory code number	Average deviation	Column type	Reflux* control	Kettle size ml.	Sample size ml.	Analyst personnel data: Experience LTFD yrs.	College training	College degree	Per cent time operating LTFD	Sex
15 lowest error results										
20	0.17	Pod. Std. Prec —4.7 MM I.D.	S	35	9	2.5	Yes	Chem.	75–90	F
20	0.19	Pod. Std. Prec.—4.7 MM I.D.	S	35	14	4	Yes	Ch.E.	75–90	F
66	0.24	Pod. Heligrid—4.7 MM I.D.	A	35	20	13	2 yrs.	None	50	M
14	0.27	Pod. Std. Prec.	M	15	full	5	5 yrs.	Pet. E.	100	M
10	0.28	High Capacity Heligrid—8 MM I.D.	S	50	29.83	2.5	2 yrs.	None	70	M
66	0.28	Pod. Heligrid—4.7 MM I.D.	A	35	20	13	2 yrs.	None	50	M
40	0.29	Pod. Hyd. Robot	A	25	12.02	5	No	None	25	M
70	0.29	Pod. Super-Cool—4.7 MM I.D.	A	25	21	0.7	Yes	Ch. E.	85	M
2	0.30	Pod. Hyd. Robot—4.5 MM I.D.	A	40	27	1	Yes	Chem.	100	M
35	0.30	Pod. Heligrid	S	50	5,000 (vap.)	0.2	Yes	Chem.	80	M
69	0.30	Pod. Hyd. Robot—4.7 MM I.D.	A	9	11.68	6	No	None	75	M
13	0.32	High Capacity Heligrid—8 MM I.D.	A	100	23.89	6	Yes	A.H.	100	M
57	0.32	Pod. Super-Cool—5 MM I.D.	A	35	15	3	2 yrs.	None	33	M
40	0.34	Pod. Hyd. Robot	A	25	11.38	5	No	None	25	M
28	0.35	Pod. Hyd. Robot—3.5 MM I.D.	A	35	10	10	Yes	Ch.E.	10	M
—15 highest error results—										
50	1.30	Pod. Super-Cool—4.7 MM I.D.	A	60	19	10	No	None	100	M
3	1.33	Heligrid—3.8 MM I.D.	A	35	6.93	2	2 yrs.	None	30	M
22	1.34	Pod. Hyd. Robot—4.5 MM I.D.	A	25	11	5	No	None	50	M
68	1.39	Pod. Int. Kettle	M	79	30	1	Yes	Ch.E.	100	M
8	1.57	Super-Cool	A	50	62.12	....	....	.....	80	M
44	1.64	Heligrid	A	9	3,500 (vap.)	6	2 yrs.	None	8	M
73	1.88	Pod. Hyd. Robot—4 MM I.D.	S	25	15	10	3 yrs.	None	100	M
36	1.97	Mod. CNGA—3.5 MM I.D.	S	25	23	6	2 yrs.	None	75	M
54	2.10	Pod. Hyd. Robot—4.5 MM I.D.	A	...	30	0.6	Yes	Chem.	30	M
41	2.41	Heligrid—4.5 MM I.D.	A	60	32	6	Yes	Chem.	95	M
36	2.61	Mod. CNGA—3.5 MM I.D.	S	25	23	6	2 yrs.	None	75	M
74	3.81	Pod. Hyd. Robot—4.5 MM I.D.	A	100	43.30	1.3	1 yr.	None	75	M
11	4.51	Pod. Hyd. Robot—8 MM I.D.	A	50	8.97	10	Yes	Soils	10–15	M
7	5.79	5 1/4 in. x 5 MM I.D.	A	75	27.75	0.4	Yes	Ch.E.	30	M
59	9.66	Spiral Packing	S	50	18.80	3	Yes	Met.E.	20	M

* A–Completely automatic — S–Semi-automatic — M–Manual.

pane factors due to analytical errors occurring in the best and mean results submitted on sample five.

In order to examine the effect of such factors, as type of apparatus, sample size, and qualifications of the analysts, the 15 lowest and 15 highest error results on each sample were compared in detail. As in the previous comparisons, no correlations are demonstrated, probably because they are masked by "human element" factors. Table 4 presents some of these comparisons made on mixture number five results.

Personnel Data

The report forms for samples four and five contained questions on the analysts' qualifications including years of experience, other job duties, and educational background. The following compilation gives some of the statistics developed from these reports:

Experience in Fractional Analysis	Number of analysts	Per cent of total	Group deviation on sample number 4
Less than 1 year	10	14	1.11
1 to 3 years	15	21	0.95
3 to 5 years	20	27	1.02
5 plus years	28	38	1.19
Total	73	100	
Educational Background			
College degree in:			
Chem. engr.	9	12	0.88
Chem.	16	22	1.20
Other	11	15	1.07
College non-grad.	28	39	1.35
No college training	9	12	1.31
Males	67	92	1.08
Females	6	8	1.11

Overall Laboratory Ratings

A total of 77 industrial and commercial laboratories participated in submitting 510 results in the liquid analysis program. Forty-five laboratories analyzed and reported on all five samples. The 10 lowest error laboratories, based on averaging the deviations on all re-

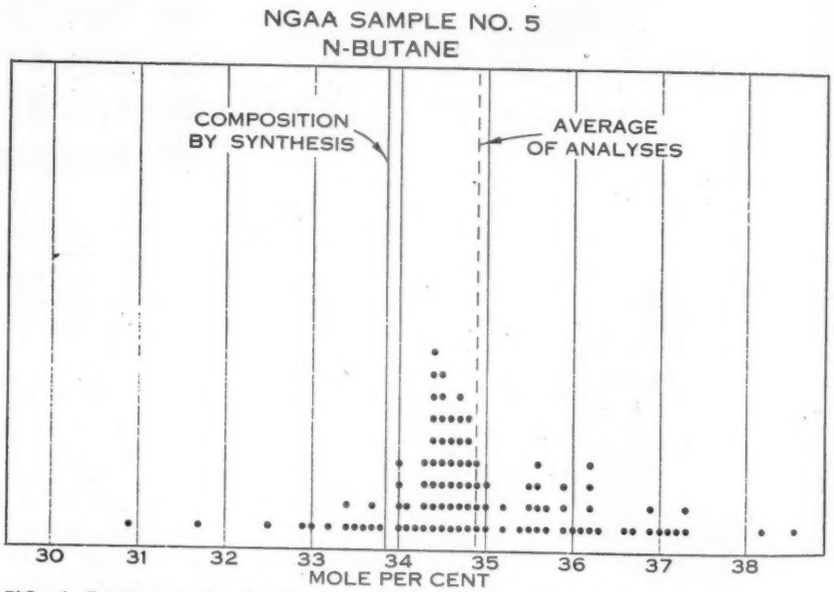


FIG. 6. Frequency distribution plot 0.1 mole per cent interval.

Wanted: More Analytical, Test, Inspection Methods

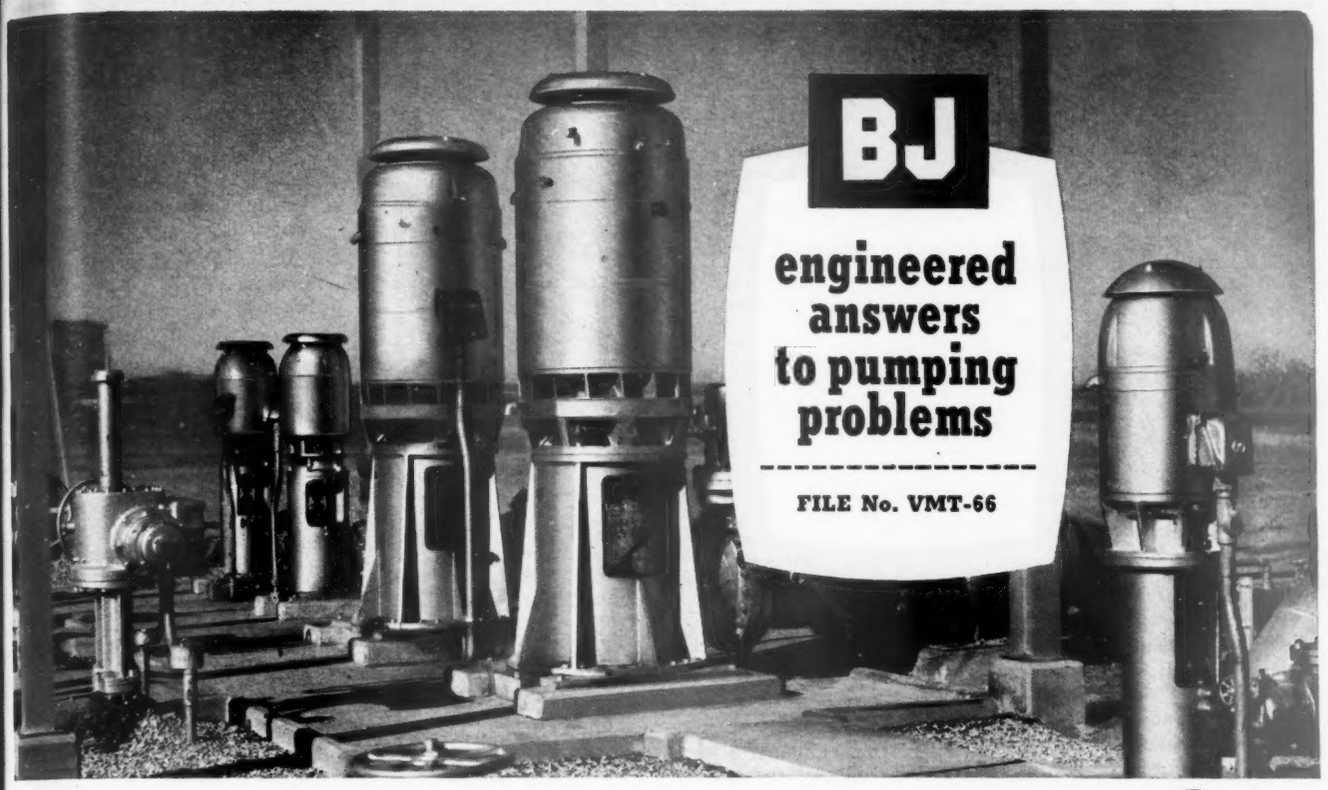
The response of the oil refining industry to our opening of our Analytical, Test and Inspection Methods section of *Refining and Gas Processing* has been very gratifying, and we are receiving articles in this field frequently—articles that will be of major interest and great use to all those concerned with this increasingly important phase of oil refining, research, and control.

This section includes the widest variety of articles, from the short dissertation of a few paragraphs on how to improve a standard method well known to the industry with brief discussion of applications, changes, and limitations of the proposed method, to major-caliber articles discussing every phase of an outstanding new method and how it helps solve a problem.

Especially are we interested in obtaining more articles on the application of the mass spectrometer, of spectrographic, infrared and other "tools" of the analyst to meet the new and varied demands of the research and manufacturing phases of the industry. New control test and inspection methods for newer type processes are in demand, also.

Send in your new and improved analytical methods for early publication!

—The Editor.



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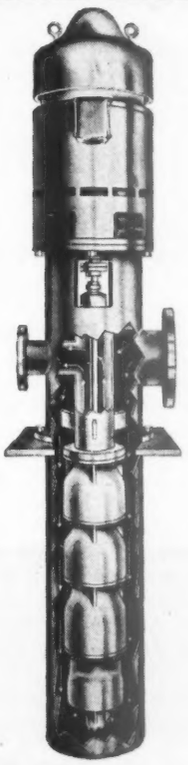

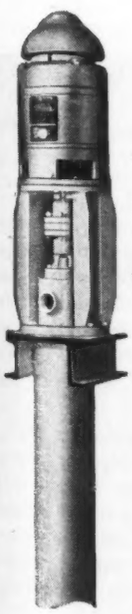

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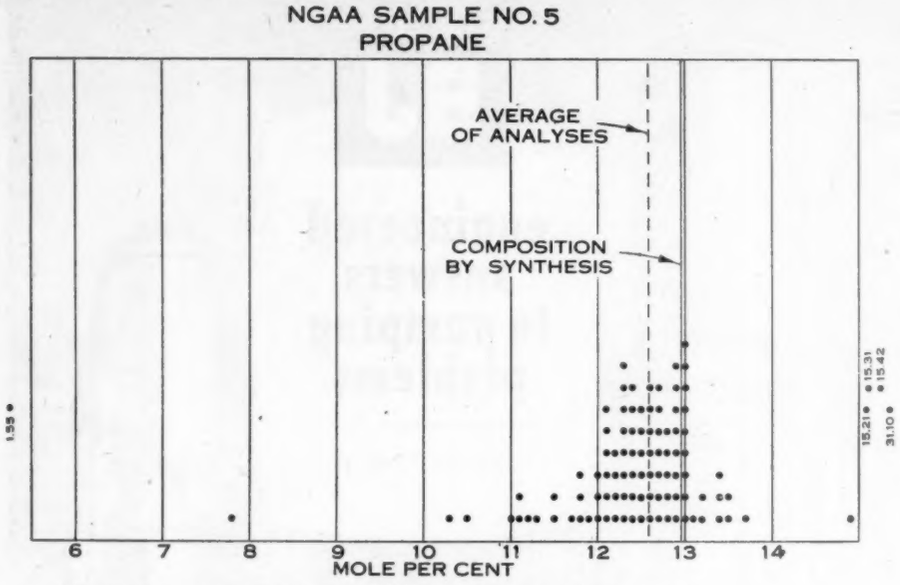


FIG. 7. Frequency distribution plot 0.1 mole per cent interval.

TABLE 5. Lowest error laboratories in program averaged for all five samples.

Rating	Laboratory Code No.	Average Deviation on All Results	No. Results Reported	Maximum Deviation Result
1	20	0.25	12	0.42
2	28	0.46	5	0.79
3	34	0.52	9	0.71
4	38	0.55	8	0.96
5	57	0.57	8	1.23
6	18	0.58	10	0.91
7	31	0.66	7	1.45
8	32	0.67	9	1.31
9	47	0.67	8	1.23
10	25	0.72	9	1.00

sults reported on the five samples, are listed in Table 5.

Laboratory number twenty submitted the highest accuracy result on four of the five samples, and rated very near the top on the other. Its outstanding record in the program demonstrates the degree of accuracy that may be attained. The data compiled on sample number five in Table 4 contain some of the characteristics of this laboratory. The two results were made by separate analysts, both female, on separate apparatus. One of the analysts has a degree in chemical engineering, the other in chemistry. Both spend from 75 to 90 per cent of their time on low temperature distillation. This laboratory uses an auxiliary column and a vapor pressure method for determining transition fractions.

What Next?

Considering the overall wide deviations in results, two suggestions may occur to the casual observer, "Replace fractional distillation with a more modern technique such as the mass spectrometer"; or "Write a standardized procedure that will effect the desired accuracy." There is an element of wishful thinking in both suggestions. Valuable new techniques are now available for some applications of hydrocarbon analysis, but as yet none promise to entirely replace low temperature distillation. Recommended procedures have already been broadly outlined. A more exacting standardization of either technique or apparatus must be preceded by an experimental program with a number of closely controlled laboratories. Along this line, it is warranted that the auxiliary techniques used by laboratory twenty be tried by a group of others.

Causes of the mistakes made in analysis are many and involve much more than technical elements. Doubtless major factors in many cases are personnel morale, interest, and attitude.

The laboratories are best able to judge their own shortcomings. Indications are that many are making sincere efforts to make corrective measures. There is a degree of human inertia to overcome, however. The report forms indicated that many contemplated revisions were not yet complete. The NGAA sponsored training school now being considered may be a means of overcoming the inertia and accelerating improvement.

Summary

1. The NGAA fractional analysis program has surveyed the accuracy of analysis of hydrocarbon liquids by low temperature distillation on an industry-wide basis.

2. The mean deviation from the true value, averaged for all components, ranged from 0.55 to 1.04 mole per cent for the various types of samples analyzed.

3. Greatest deviation occurs on separations of isomers.

4. The application of holdup corrections has reduced but not eliminated the tendency towards low analytical values for the lowest boiling component.

5. Accuracy has improved since the earlier gas analysis program and again since the first phase of the liquid analysis program, but still further improvement is needed.

6. Major errors are not due to basic procedures or apparatus and are attributed to human element factors, such as improper application, lack of understanding, inadequate training, miscalibrations, etc.

7. Under consideration as possible next steps in the program are an analyst training school and trial of certain promising auxiliary techniques in a group of laboratories.

8. Certainly the program has stimulated interest in attaining higher accuracy and provided a yardstick to give the conscientious laboratory a basis for self-appraisal and self-improvement. Although slow, this may represent the best route to the higher overall accuracy needed today—and that will be even more urgently needed tomorrow.

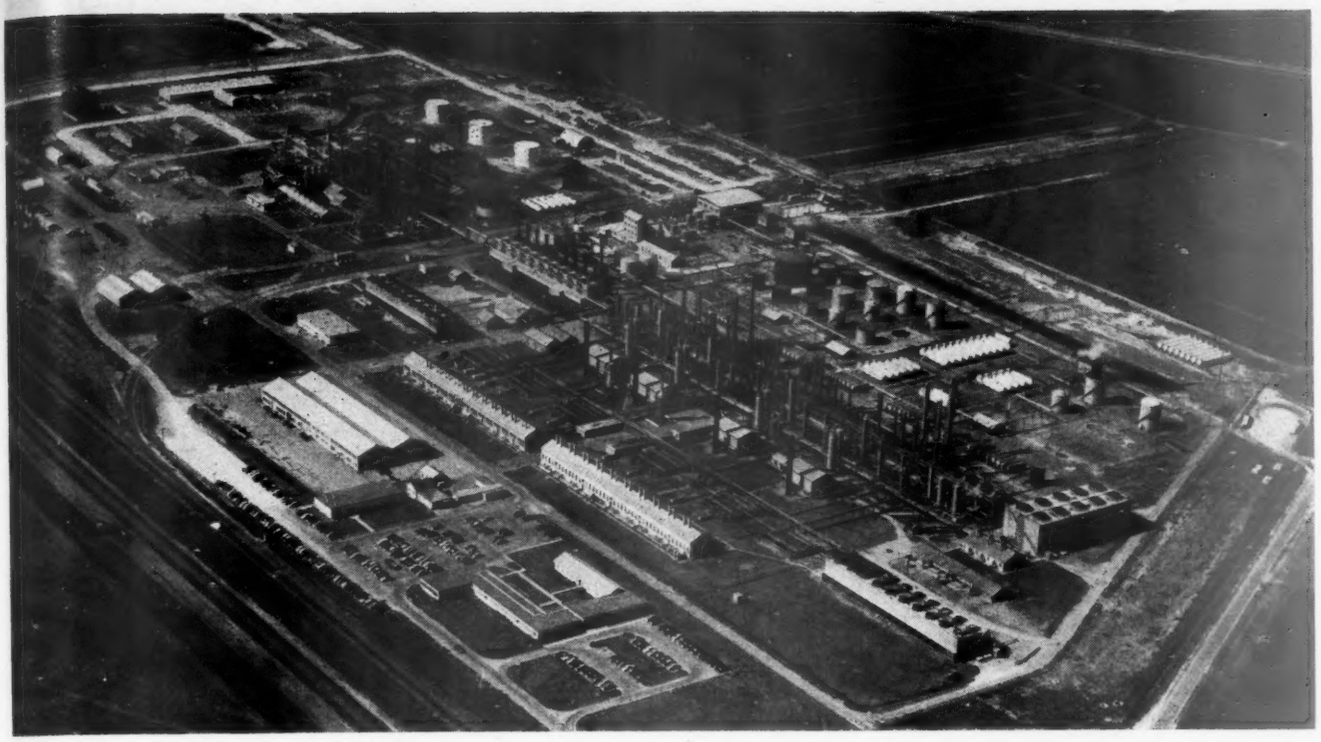
Acknowledgment

The fractional analysis program has been conducted by the Fractional Analysis Subcommittee of the NGAA Technical Committee. The questionnaires and report forms were prepared by Fred Zapffe of Lone Star Producing Company and M. F. Wirges of Cities Service Oil Company. F. D. Stoops of Phillips Petroleum Company made many of the calculations and correlations. * * *

Army Testing New Cold Start System

Frigid winter starting troubles will be solved if a new system under test by the Army proves to be successful. It includes a conventional spark plug and a type of precombustion chamber, and is called the gasifier, according to a report by the Army.

Some of the regular fuel used in the engine is burned to heat and vaporize the main body of fuel as fed to the engine's carburetor. The resulting warm, vaporized, charge-air mixture is taken into the engine cylinder and is burned in the regular manner to warm up the engine to enable it to operate properly at extremely low temperatures. In a few minutes the engine is running properly and the gasifier is cut out of the operation. The gasifier is claimed to start an engine in 30 sec or less at minus 65 F temperature. It requires no auxiliary equipment, and uses the same engine fuel from the regular tank. It does require adequate starting power for the low temperatures. If successful, estimates say it will save the military forces a good deal of money; estimates also indicate that motorists in this country waste $1,000,000 to $2,000,000 in fuel in cold starting anually.



Celanese plant at Bishop, Texas, making oxidized organic chemicals from natural gas.

Petrochemicals and Cellulose Acetate From Plant at Edmonton, Canada*

Application of perforated and of bubble plates shows interesting results in chemicals separation

DAVID R. KECK

With the huge industrial expansion taking place in Canada, Celanese officials recognized that a two-fold purpose could be served by a plant such as is being built at Edmonton. First, the production of a number of basic organic chemicals would have broad application in defense and peacetime economics and would contribute to the industrial self-sufficiency of Canada. Second, the plant would utilize a portion of the cellulose from British Columbia to provide a large percentage of the cellulose acetate requirements of both the textile and plastics industries of Canada. The Canadian Government shared this opinion and the decision was made to construct a plant to produce 25,000,000 lb of cellulose acetate flake yearly and considerable quantities of organic chemicals. Ten million pounds of the acetate flake will be further processed to filament yarns and 5,000,000 lb will be processed to staple fibers.

The Edmonton process is the same as used at Bishop, Texas, with modifications where necessary.

Feed stock to the plant will be from two sources, liquefied butane and propane from gasoline plants, and recovered gases from Edmonton refineries. As a sweet feed is required, an H_2S removal unit is being provided for treating the refinery gas streams prior to their being fed into the oxidation unit.

The hydrocarbons in the feed are converted to oxygenated chemicals by partial oxidation with air under carefully controlled conditons of temperature, pressure, and reaction composition. After the chemicals have been formed, they are removed from the gas stream for recovery of the individual components.

Products formed in recoverable quantities in the oxidation reaction are formaldehyde, acetaldehyde, propionaldehyde, acrolein which is the unsaturated form of propionaldehyde, propylene oxide, methanol, acetone, and mixtures of heavier aldehydes, oxides, alcohols and ketone. Acetals, and a number of other unpronounceable compounds are also formed in trace quantities.

Some of the formaldehyde will be marketed as a 37 per cent formalin solution. The remainder will be reacted with acetaldehyde to make pentaerythritol, which will be produced for the first time in Canada at the new Edmonton plant.

Acetaldehyde will be available for sales, but the majority of this material will be further oxidized with air to form acetic acid.

Acetic acid production capacity will be sufficient to supply considerable

*Condensed slightly from a paper, "Canadian Chemical Company's Edmonton Plant" given by the author before the Chemical Institute of Canada, Hamilton, Ontario, March 4, 1952.

Steel work on the secondary oxidation building of Canadian Chemical plant near Edmonton has been completed and roof and walls are now being added. The chemical plant, which will use as raw material approximately 75,000 gal of natural petroleum hydrocarbons, will produce a wide variety of chemicals, including pentaerythritol, methanol, formaldehyde, acetaldehyde, acetic acid, acetone and propylene glycol.

quantities to the Canadian market, as well as to provide the amount needed for cellulose acetate manufacture. Upon being fed to the cellulose acetate plant, acetic acid is first converted to acetic anhydride. Then acetic anhydride is reacted with digested wood pulp or cotton linters to form cellulose acetate, the type of cellulose used being determined by the properties desired in the finished cellulose acetate. It is interesting to note that the original cellulose acetate was made entirely from cotton linters. Since that time, however, the percentage of linters has been continuously decreased until no linters will be required for the Edmonton plant at all.

Propionaldehyde and acrolein will be reacted with pure hydrogen to form normal propanol. A hydrogen unit is being built to supply the necessary hydrogen. From this operation the first tank car quantities of normal propanol were produced in the United States.

Methanol and acetone will be purified for sales from the primary oxidation product.

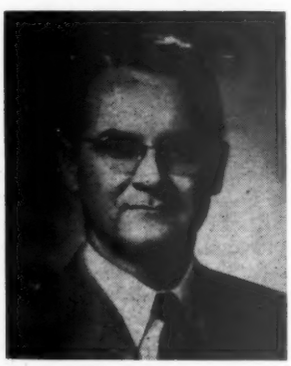
Propylene oxide will be hydrolyzed to propylene glycol and dipropylene glycol for sales.

A utility distillation unit will be installed to recover such compounds as butyl alcohols, various solvent cuts, and to react acids and alcohols to form a number of different esters.

The petrochemical portion of the plant will be laid out in six areas, each approximately the size of a city block with streets completely surrounding each block. This type of layout is being employed to facilitate changes to any of the equipment which might be desired. This action results from our experience at Bishop, Texas, in which no more than 40 per cent of the fractionating towers are performing the same service as they did in the original plant installation.

Due to severe climatic conditions, the plant will be almost entirely housed. Only the fractionating towers, above a height of about 16 ft, will be exposed. The tower sheds will also house the tower reboilers. The main buildings will have two floors. The ground floor will house pumps, pipe lines, control rooms, electrical control rooms, tool rooms, offices, unit laboratories and locker rooms. The second floor will house the heat exchanger equipment and small tanks. Product surge tanks will be horizontal cylindrical tanks whose ends will project into sheds along the sides of the buildings opposite the towers. Product transfer pumps will be placed in these sheds.

The first of the areas will contain the feed sweetening unit and the hydrogen plant. These two units are housed together because they are both supplied by the Girdler Corporation, while the remainder of the plant is being built by the Brown and Root organization.



David R. Keck, the author, Canadian Chemical,

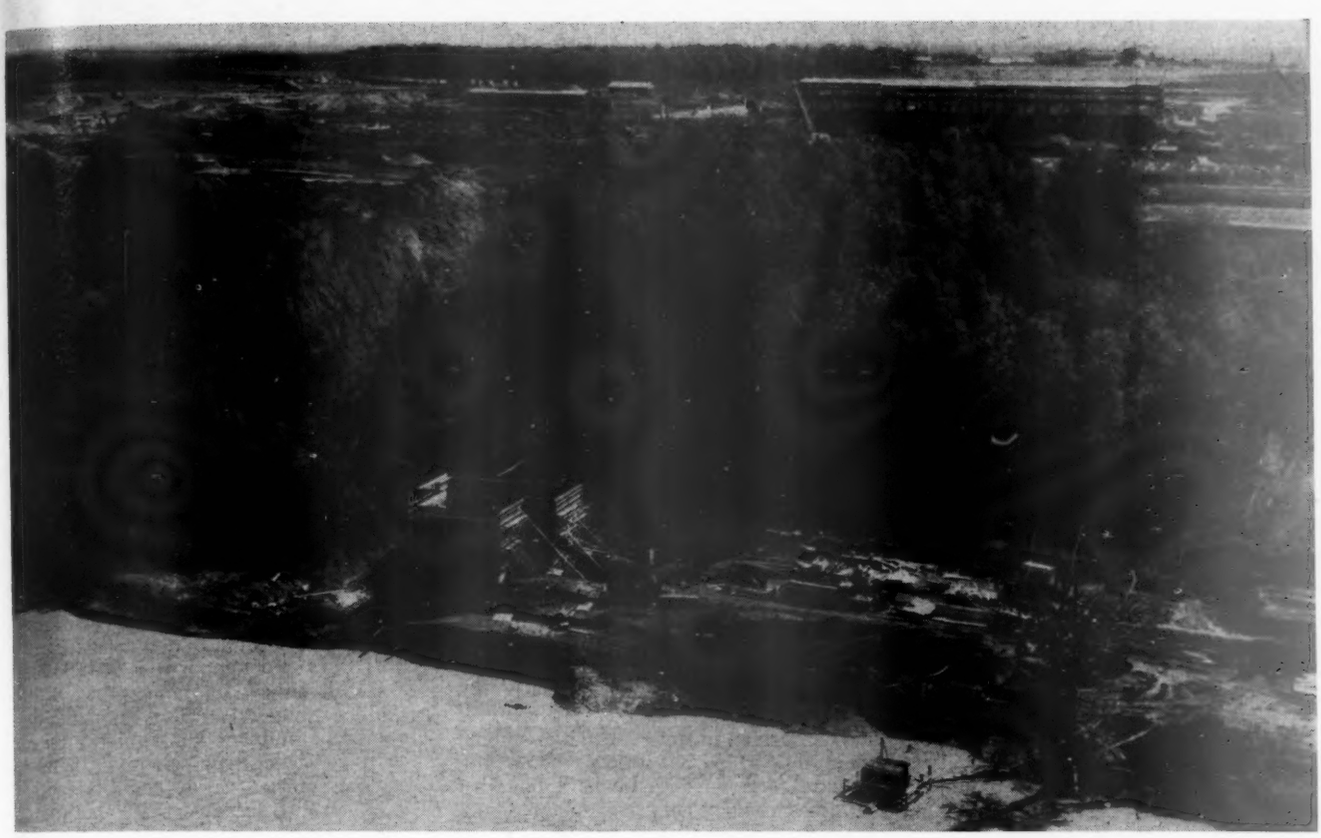
The second of the areas is occupied by the primary oxidation unit. Feed gas is supplied from the Girdler sweetening unit for conversion to oxygenated chemicals. Two chemical streams leave the oxidation unit, one of which is predominantly formaldehyde while the other contains the remainder of the chemicals produced in the primary oxidation. The formaldehyde containing stream is pumped to a separate area where it is either purified to the 37 per cent formalin solution for sales or converted to pentaerythritol.

The main chemical stream from the oxidation unit is pumped to the products purification unit, which is the largest unit in the plant, containing about 25 towers and extractors. Straight distillation, azeotropic distillation, extractive distillation, and liquid-liquid extraction are employed in the products purification unit to make the desired cut between the products of the complex feed mixture. This unit also includes the propylene glycol and hydrogenation equipment. The pure acetaldehyde recovered here is either sold on the market or sent to the acetic acid unit.

Although the oxidation of aldehyde to acetic is a relative simple reaction, extensive distillation and extraction equipment are required to produce a pure acid product and at the same time recover all of the acetic acid from the side reaction products formed in the reactor.

A number of narrow boiling range, complex mixtures of products are separated in the products purification unit. These products are distilled batch-wise in a utility distillation unit to produce various solvents. Some extremely powerful solvents are concentrated in these streams.

The aforementioned products will be



Water from the North Saskatchewan River will be used to supply the Canadian Chemical Company Limited petro-chemical plant now under construction near Edmonton. This picture shows the site of the pump house on the banks of the river.

shipped by rail. All liquid products will be handled either in drums or tank cars while solid products will be shipped in box cars. A considerable storage capacity is being provided for each product to permit steady operation of the plant, should delays in the tank car movements to or from distant points cause erratic shipping rates.

Although I am obviously not free to discuss process details further with you, I would like to tell you some of the improvements in the field of chemical engineering unit operations, which we have incorporated in the design of the Edmonton plant. As pointed out previously, we make extensive use of all types of distillation to obtain the degree of purity required of our products. Approximately 60 distillation towers will be installed in the petrochemical portion of the plant. In the early operation of the Bishop plant considerable difficulty was encountered in the operation of fractionating towers on compounds with which most of us had had no previous experience. Considerable increases in the capacities of these towers were achieved by rearranging flow patterns and blanking bubble caps according to published procedures. We were not, however, completely sure of some of the calculation methods for predicting performances of bubble trays. For this reason a 6½ ft diameter experimental tray, equipped with an 800 gal per minute pump and a 16,000 std cu ft per minute air blower, was installed. Data obtained on this experimental unit checked quite closely with the information most recently published by Davies of The Texas Company in the *Petroleum Refiner*. With this information on bubble trays available it was suggested that a sieve tray or perforated tray be installed in our experimental unit for comparison with the bubble tray operation. After a search of the published data on sieve trays, the hole pattern was decided upon and the tray was fabricated. It was immediately obvious that the operation of this tray was very superior to that of the experimental bubble tray. As soon as sufficient information was obtained to justify a plant installation, management agreed to the installation of sieve trays in a 6 ft diameter, 60-tray tower, which was being added to the purification unit at that time.

All experimental data were obtained on air and water. The first objective, therefore, of a plant scale installation was a study of sieve tray efficiency as compared to bubble tray efficiency. Two alcohols with known relative volatilities were selected for the comparison. An idle 2 ft diameter bubble tray column was operated concurrently with the sieve tray column for the study. This study revealed two things. First, that the sieve tray efficiency was approximately 20 per cent above that of the bubble tray, and second that the efficiency of the sieve tray did not vary over the experimental range covered as the operating load in the column changed. Unfortunately, the boiling range of the test mixture, N-propanol -secondary butanol, was higher than the design liquid and it was impossible to run the sieve tray column up to maximum capacity due to limitations in reboiler capacity. Those of you familiar with the bubble tray efficiencies are aware, of course, that bubble tray efficiencies are low at low throughputs, rise to a maximum and then fall off again at high throughputs. After these data were obtained, the 60-sieve tray tower was put in service and has operated satisfactorily for about two years now.

Some additional advantage of the sieve tray column are its simpler construction and consequently lower cost, its easier maintenance, and its higher capacity. Although we are not in position to guarantee it, we feel that sieve trays as we design them offer 15 to 20 per cent higher capacity than a bubble tray of the same diameter. The absence of hydraulic gradient on sieve trays is one of the reasons for this greater throughput.

One would think from the preceding description that sieve trays are the answer to all of our woes. Certain limitations, however, make it necessary for us to use bubble trays in some cases. These are high vacuum and distillation under extreme foaming conditions. In order to get good distribution of the vapors through holes in the trays it is necessary that at least 2 in. of liquid pressure drop be maintained on all sieve trays. For this reason its use is limited in vacuum service. If one were to set out to make foam, one would employ a large number of small holes with vapors passing through the holes as in a fritted gas tube. While our holes are larger than those in a fritted gas tube, the principle is the same. We feel that the extreme number of small holes in the sieve tray is the contributing factor to its higher

efficiency since the objective in a fractionating tower is to get intimate contact of the vapors and liquids. For your general information we use 3/16 in. thick carbon steel plate and 3/16 in. diameter holes. It is hoped that we will be able to publish all of our sieve tray data within the next year. The paper has recently been prepared and will be submitted for publication soon. We are now operating about six sieve tray columns at Bishop with diameters up to 8 ft. The new Celanese plant at Pampa, Texas will be predominantly sieve tray tower and about three-fourths of our towers at Edmonton will have sieve trays.

In the preceding discussion of operating processes which we employ, liquid-liquid extraction was mentioned. It was noted early in our operations that low extraction efficiencies were being provided by our conventional ring and disk trays. Data were available that indicated that some people were employing perforated trays of various kinds for contacting the two liquid phases in liquid-liquid extraction. As no specific data were available, a pilot plant was constructed in which perforated trays were installed inside of glass bell and spigot pipe. Preliminary information obtained on this 2 in. column were used to design a 6 in. diameter glass column. Data obtained on the larger column were sufficiently encouraging to warrant the installation of the perforated tray in all of our new and most of our existing liquid-liquid extractors. The construction of the tray is as follows:

Downcomers or upcomers, depending upon the direction of the flow of the continuous medium are installed similar to downcomers in fractionating columns. With the continuous phase flowing down the column, the dispersed phase collects beneath the tray, where it is forced up through the holes into the continuous medium at a velocity above the streaming velocity, but at a velocity slow enough to permit individual droplets of uniform size to form as the liquid passes into the continuous phase above. Bypasses are provided for any emulsion which builds up between the phases or in case the flow of the dispersed phase exceeds the capacity of the trays. It was interesting to note that for a given height extractor about 50 per cent more extraction stages can be installed using the sieve tray as compared to the ring and disc.

Early installations of sieve trays were made by using drilled trays; however, the drilling cost for each succeeding installation was about 50 per cent higher, and it is now the practice to buy mechanically perforated trays. If excessive holes are present in any portion of the tower these holes are blanked off by tack welding thin strips of the same kind of material over the excess holes. This program fits in well with our standardization program within the plant as it permits all sieve trays for a given tower diameter to be perforated to the same pattern and the exact number of holes to be provided by blanking off.

Another improvement we are including in our plant is the use of the thermo-siphon reboilers. The normal practice for years past has been to use kettle type reboilers that are small tanks with tube bundles inserted in one end for heating the liquid flowing from the base of the tower. In the kettle type reboiler the liquid from the base of the tower flows around the outside of the steam heated tubes and only the vapor required to supply the demands of the column leaves the reboiler and flows back into the tower. The thermo-siphon reboiler, as we employ it, has tubes either 5 ft of 6⅔ ft long, so that 3 or 4 tubes can be cut from a standard 20 ft length of tubing. The steam flows around the outside of the tubes while liquid enters the vertical tubes from the bottom and flows up through the tube. As the liquid flows up the tube a portion of it vaporizes, lowering the density of the liquid inside the tube to such a point that an extremely high velocity results, with the corresponding increase in heat transfer coefficient. We have one operating reboiler of this type which operates with an overall heat transfer coefficient of 800 Btu per hour per square foot per degree F. Except for high vacuum service we normally use an overall heat transfer coefficient of 500 for design purposes with a maximum heat flux of 50,000 Btu per hour per square foot. To date we have installed approximately 10 thermo-siphon reboilers at the Bishop plant and have so far succeeded in having them all too big. As the above design method is not very scientific, a pilot unit has been installed and data are currently being obtained on a variety of products that will permit us to design these reboilers on a sounder basis. We feel, however, that our present basis is sound enough for their installation as the square feet required per bundle is only about half of that which would be required in the conventional kettle type reboiler.

In the sizing of thermo-siphon reboilers we have selected about 5 or 6 standard sizes, and these are constructed such that either the tube bundle alone or the entire unit is completely interchangeable with most of the other units of similar size in the plant. With this in mind, we will be able to stock spare reboilers, which will fit in many places. As a point of general interest with the short length of tubes used in this type of reboiler, we do not find it necessary to use expansion joints or floating tube sheets to take care of thermal expansion of the unit. As a matter of fact we do not use floating tube sheets in any of our heat exchangers as unequal expansion of the bolts and floating head flanges can result in minute leaks that would contaminate our products, most of which have impurities limited to a few parts per million.

Another feature of our plant is the standardization of pumps. Excluding special pumps for extremely large quantities or extremely high heads, there are very few different pumps within our plant. For example in the cast iron and steel line there are no more than six different sizes of pumps and most parts of these are completely interchangeable with each other. Although some efficiency is sacrificed by this method of pump selection the investment for spare parts and warehouse space is kept at a minimum. Further, by the purchase of large numbers of pumps of exactly the same description, a considerable price advantage is obtained from the manufacturer. Each pump installed will be so mounted that the largest size motor demanded by that pump under any conditions can be installed. With this type of installation we will have the utmost of flexibility in our pump equipment.

Standardization of the instrumentation of the plant is being carried out so far as possible and instruments are being purchased on blanket order in the same manner as valves, pipe fittings, etc. Thus any instrument received will be suitable for installation any place in the plant and will not receive a tag number or be given a name until it is actually installed.

To depart from the installation of the Edmonton plant an interesting development in cooling should be mentioned. Most of us think of air as a poor cooling medium; yet, upon examination of finned tubes and finned tube installations available today, one finds that if the cooling temperature is about 80 deg above the ambient air temperature, air cooling becomes competitive with water cooling. Most areas of the US are not as favorably situated with regard to fresh water as Canada is today. For this reason more and more people are looking to air cooling as a solution to their water supply problems. Even in areas where water is plentiful it is becoming increasingly desirable to use air cooling for the higher temperature services to increase the run length of the equipment. Extended run lengths with cooling water equipment can be achieved only if expensive treatment of the water is provided. An indication of the cost of cooling water treating is that more money is spent for chemically treating one gallon of cooling tower makeup at the Celanese plant at Bishop than is spent for chemical treatment of one gallon of boiler makeup water. One might ask "Is this expenditure justified"? It should be pointed out that exchangers in this plant that were formerly scaled at the end of 90 days do not now require cleaning at the end of one year's operation. If scaled exchangers are the only reason for a down time then one can easily say that the cooling water treatment is justified. On the other hand, however, if one can install an air cooler in place of a water cooler, with the same horse power requirements as the cooling tower fans and pumps, and eliminate the chemical treating cost, then the move should certainly be made. In the operation of finned tube air coolers, coefficients between 80 and 100 Btu per hour square foot per F based on the internal area of the tube are not uncommon. This high coefficient is due to the high ratio of external finned surface to internal surface.

Based on the above experience, 79 per cent of the cooling load at the new Celanese plant at Pampa, Texas, will be supplied by air-finned coolers. This is expected to be the largest installation of its kind in the world. * * *

EXCLUSIVE

LAMINATED THERMOSETTING PLASTICS

High mechanical strength, corrosion resistance, and low moisture absorption are outstanding features

F. C. McCAMLY*

LAMINATED thermosetting plastics such as produced by Synthane Corporation are becoming increasingly important to equipment designers as component materials in the oil and gas industries. Laminated plastic gaskets, sleeves, washers, bushings, nipples, and couplings combat electrolytic corrosion as insulators in flow lines and at processing and storage installations. Mechanical components such as valve heads, seats, seat inserts, and stems—at operating pressures as high as 2000 psig—are made of laminates when they are in direct contact with highly corrosive oils and gases. Pump and compressor rings, valve balls, and thrust plates, and insulators in geophysical equipment are also made of thermosetting plastics.

A combination of mechanical, electrical, and physical properties that well exceed operating requirements and excellent corrosion resistance is the basis for the specification of plastic laminates. In no application was the equipment designer concerned with only one property of the material. High mechanical strength, good corrosion resistance, low moisture absorption, and small deformation under load, for example, are required of both flange insulation and valve components. Properties of the most commonly specified fabric-base laminates, Grades C and C-CR, are given in Fig. 1. In addition, the lightness and machinability of plastic laminates are valuable in design and production.

A complete set of flange insulation includes a gasket and the required number of bolt sleeves and washers. Three types of insulating gaskets (Fig. 2) are raised-face, full-face, and ring-joint. The tongue and groove is another type of gasket often used. Raised-face gaskets are made from Grade C laminated plastic sheet stock either ⅛-in. or 3/32-in. thick. Grade C fabric-base laminate is used because a high compressive strength is particularly important.

In Fig. 2, the raised-face gasket has an ID equal to that of the pipe and an OD equal to that of the bolt circle minus the diameter of the bolt hole. The full-face gasket is also made of Grade C sheet stock with an ID equal to that of the pipe. The outside diameter of the full-face gasket is equal to that of the flange and is pierced to pass the bolts in the flange. Ring-joint gaskets are machined from Grade C laminated tubing or sheet in accordance with API dimensional specifications. The ring-joint gasket is made to fit into a circular groove within the bolt circle on the flange face. Each of the three types of gaskets is shown in Fig. 3: Full face (left), ring joint (lower right), and raised face (upper right).

Raised-face and full-face gaskets are manufactured in sizes meeting the requirements of API classes from 150 psi to 2000 psi. Ring-joint gaskets are manufactured in sizes corresponding to API classes from 150 psi to 7500 psi. Each type of gasket has been designed with a sufficient safety factor to withstand pressures well over working values. Bolt sleeves (Figs. 2 and 3) are usually Grade C or Grade L laminated tubing with a 1/32-in. wall thickness. The sleeves extend through both flanges to prevent the occurrence of closed circuits caused by off-center bolts touching the flange.

To complete the flange insulation, a laminated plastic washer made from ⅛-in. or 3/32-in. thick Grade C sheet stock is placed over each bolt under a steel washer. The outside diameters of the washers are somewhat smaller than standard. SAE washers are used because the spot facing on the bolt holes of a flange is smaller than the OD of a standard washer. It is not necessary, of course, to install an additional insulat-

*Synthane Corporation, Oaks, Pennsylvania.

FIG. 1. Characteristics of grades C and C-CR laminated plastics.

Characteristics	Sheet	Tubing Molded	Rods Rolled	Rods Molded
Tensile strength, psi	1200 lw 9000 cw (average) [a]	8500 (average) [d]	6000 (average) [d]	9000 (average) [e]
Compressive strength, psi	37,000 (flatwise average) [a]	19,000 (axial minimum) [d]	12,000 (axial minimum) [d]	19,000 (axial minimum) [e]
Flexural strength, psi	17,000 lw 16,000 cw (minimum) [a]	—	—	16,000 (minimum) [e]
Dielectric strength (short time) volts per mil	200 (average) [b]	175	—	—
Moisture absorption, per cent by weight	4.4 (maximum) [c]	2.0 (maximum) [d]	3.0 (maximum) [d]	2.0 (maximum) [f]

lw—lengthwise
cw—crosswise

(a) ⅛ in. thick at 23 C. ASTM Method D-229-46. (b) 1/16 in. thick under oil. ASTM Method D-149-44. (c) 3 by 1 by 1/16 in. samples. ASTM Method D-229-46 after immersion in H_2O for 24 hr at 23 ± 2 C. (d) 1 in. ID by 1¼ in. OD; samples at 23 C. ASTM Method D-348-46. (e) ASTM Method D-349-42 at 23 C. Rods ½ to 1 in. diam. (f) ASTM Method D-349-42 at 23 C. Rods ½ in. diam.

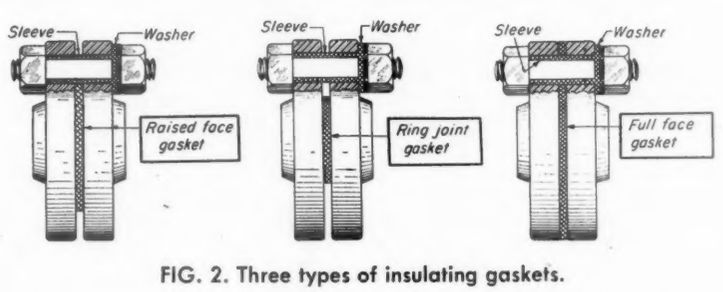


FIG. 2. Three types of insulating gaskets.

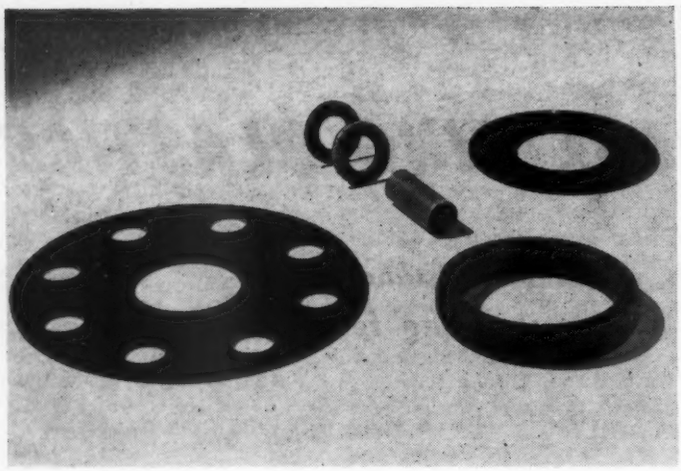


FIG. 3.

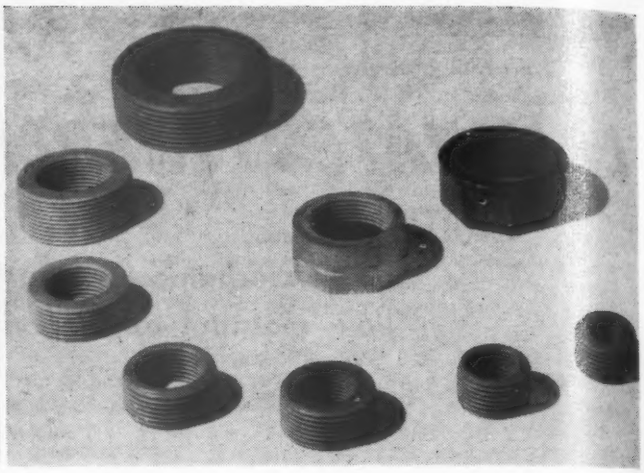


FIG. 4. Seven bushings machined from laminated plastic tubing, and two meter nuts with plastic lining (upper right).

ing washer on the other side of the flange in order to break the circuit, but this practice is recommended to facilitate future electrical testing of the flange insulation.

Cathodic protection of a city gas distribution system is usually provided by isolating the system with insulating pipe fittings in gas meter loops. The most common insulating components in meter loops are plastic bushings. In Fig. 4, seven bushings of the all-thread type in various sizes have been machined from Grade C laminated plastic tubing. Another method of protection is to insert a meter nut with a laminated plastic lining (Fig. 4, upper right) at the gas meter. The plastic insert, machined usually from Grade C laminated tube stock, is threaded both externally and internally and is screwed into the metal nut where it is permanently cemented in place. Another method of insulating gas meters uses a metal coupling fitted with a laminated plastic insert (Fig. 4).

Laminated plastics are also used as insulation in auxiliary anodes providing cathodic protection of the metal walls of processing equipment. The anode in Fig. 5, for example, has been designed for installation on oil emulsion treators to (1) prevent accumulation of a hard adherent scale on the fire tube and (2) to provide cathodic protection for the inside of the treator. The anode prevents corrosion of the metal walls by making the entire metal surface a cathode, thus eliminating local cell action.

In Fig. 5, Grade C-CR laminated plastic sheet has been machined to form the inside and end insulators in the head section of the anode. The inside and end insulators are 3¾ in. OD by 2 in. long and 4½ in. OD by 2 in. long respectively (for magnesium anodes). The ID of the plastic insulators are made sufficiently large to pass the steel core of the anode. Because anode insulators are often exposed to sour oils and other corrosive liquids, the high corrosion resistance of Grade C-CR is essential. In addition, the low density and excellent machining qualities of the laminate contribute to a lighter, more easily produced auxiliary anode.

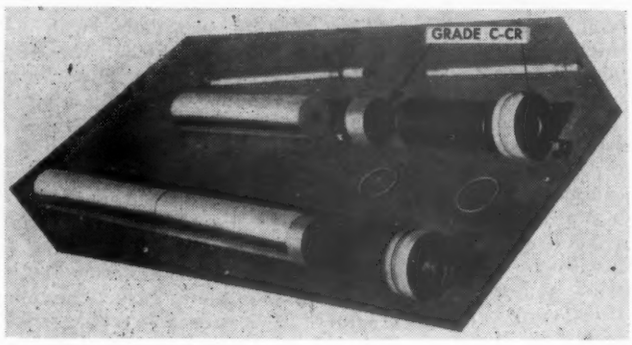
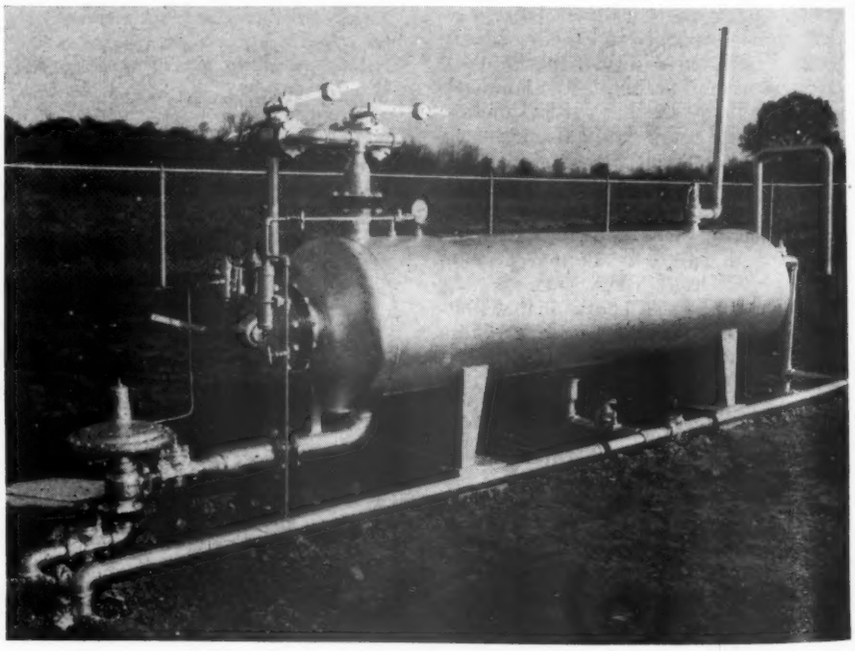


FIG. 5. Laminated plastic anode.

Laminated plastic valve components are used extensively in the control of corrosive oils and waters in storage and in transfer. In such applications valve components must have high mechanical strength because they are often exposed to high continuous and impact stresses. Equally important, however, is that these components maintain their mechanical properties for long periods even though exposed to highly corrosive oils and gases. Grade C laminates are specified because they have been found to resist corrosion under exposure to all known natural crudes and natural gas, whether sour or sweet.

The selection of laminated plastics or metals as component materials depends on the design and function of a particular valve. One manufacturer, for example, uses laminated plastic valve discs and stainless steel seats on single-seated

FIG. 6. Valve (at left) using plastic valve seat.



Ashland another leading refiner who desalts with PETRECO

The Ashland Oil and Refining Company and its affiliated companies are a fast growing and highly progressive organization. Like other leaders in the refining field, Ashland relies on Petreco Desalters to keep their crude charge free from harmful salts and solids. Like the many other experienced refiners who specify Petreco Desalting repeatedly, the Ashland group has installed Petreco in their refineries at Ashland, Kentucky; Canton, Ohio and Buffalo, New York.

Leading refiners such as the Ashland Oil and Refining Company have learned that Petreco Desalters consistently deliver high-efficiency performance, and are kept at this high performance level by helpful, dependable Petreco service engineers. **PETRECO OFFERS COMPLETE DESALTING SERVICE AND FACILITIES**

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ELECTRIC PROCESSES FOR THE PURIFICATION OF PETROLEUM

PR 51-6

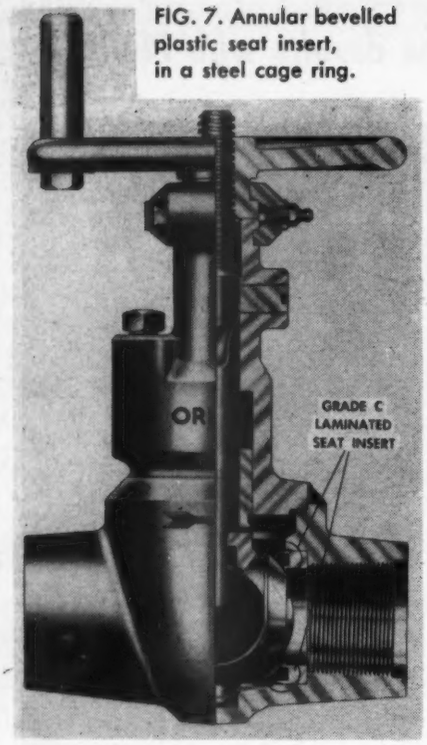


FIG. 7. Annular bevelled plastic seat insert, in a steel cage ring.

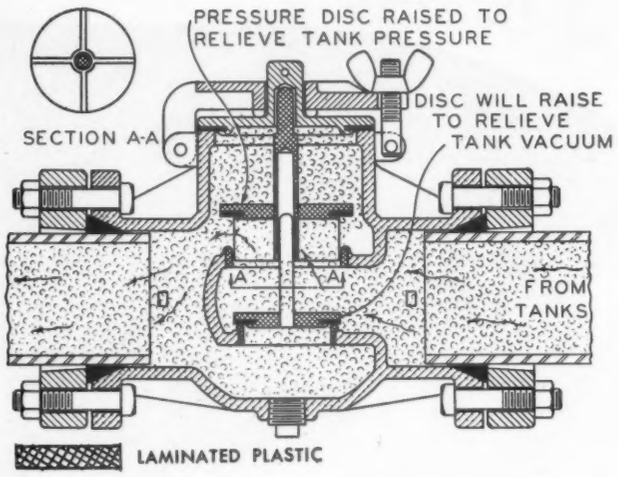


FIG. 8. Pressure-vacuum valve with plastic discs, stems, and seat inserts.

diaphram valves for oil or water. The company has found laminated plastics to be the answer for tight shut-off and corrosion prevention of the valve itself. In Fig. 6, a valve of this design is situated at the left of a horizontal oil and gas separator.

In Fig. 7, the valve seat insert in a forged steel valve is made of Grade C laminated plastic. The plastic sheet material is machined into an annular bevelled ring that is retained in a steel cage ring. The valve seat is pressed into the valve body and remains stationary throughout operation. The spherical face of the seating core contacts the bevelled face of the laminated insert.

The resiliency of the laminated plastic valve insert makes it possible to obtain the complete and positive shut-off so important in valves. The valve in Fig. 7 employs a friction-free seating design that eliminates all friction between the rotating and rocking core and the laminated insert. In active service over 15 years, thousands of these valves are holding pressure with no appreciable wear on the plastic insert.

In Fig. 8, laminated plastic discs, stems, and seat inserts are used in a combination pressure-vacuum valve for installation in vapor lines on crude oil storage tanks. The valve is used (1) to protect tanks from high pressures caused by vaporization of the more volatile parts of crude oil, and (2) to permit air to enter the tanks when a partial vacuum is created by condensation of vapors or while tanks are being emptied. To insure trouble-free service in areas where there are highly corrosive gases, Grade C-CR laminated plastics are used for those valve components whose operation must not be impaired by corrosion.

Laminated plastic pump and compressor rings, machined from Grade C or CYB sheet stock, are specified principally because they require less lubrication, last longer and do not score cylinder walls. Other important characteristics of plastic rings are good corrosion resistance, high mechancial strength, resliency and low moisture absorption (to avoid binding). The rings, varying from $\frac{3}{8}$ to 1 in. in thickness, are made for piston diameters from 4 to 30 in. and are square or nearly square in cross-section. Selection of the *one-piece* or *segmental* type of ring depends on the equipment design, although the one-piece ring is not normally used in the larger diameters. The segmental ring, made in three sections to allow for expansion, is pressed against the cylinder by a steel expander ring on the inside of the plastic ring. With only a single cut, the one-piece ring is tensioned so as to bear against the cylinder walls and provide expansion as the ring wears.

Valve balls and valve seats of turbo-jet float shoes are made of molded-macerated plastics, which have the required mechanical properties and yet are easily drilled out when cementing work is completed. For the same reasons, the thrust plates on turbo-jet float shoes are Grade C laminated plastic.

The geophysical departments of most major oil companies and manufacturers of geophysical equipment are users of laminated plastics as insulating components in their instruments.

Formation of Petroleum — Role of Mineral Catalysts

Benjamin T. Brooks

The problem is essentially to account for the formation of the large number of paraffins, cycloparaffins, and aromatics in petroleums, within the permissible temperature limits. In view of the stability of hydrocarbons at low temperatures, in the range 100 to 250 F, it is believed the aid of a catalyst is required.

Support for this is found in the known catalytic properties of fuller's earth and other acid silicate minerals and synthetic catalysts, in recent studies of catalytic cracking, in the composition of petroleums, in geological evidence of change in composition, in the carbonium ion reactions which are now generally accepted to account for polymerization by acid catalysts and the reactions occurring in alkylation and isomerization. Carbonium ion reactions offer the first plausible explanation of the formation of aromatics at low temperatures. An explanation of the formation of cycloparaffins is given, involving carbonium ion reactions of acyclic unsaturates. All the evidence points to unsaturated fatty oils or acids as the original source material.

Abstract from American Chemical Society.

Acknowledgment

Acknowledgment for information is made to the following companies: Enardo Manufacturing Company, Halliburton Oil Well Cementing Company, F. H. Maloney Company, Johnson-Fagg Engineering Company, National Tank Company, Nelson Electric Manufacturing Company, Orbit Valve Company, and Service Engineers, Inc. * * *

NEWS

Phillips Completes Plans For Natural Gasoline Plant

Phillips Petroleum Company has completed plans for its Pembrook natural gasoline plant in the Spraberry Trend, West Texas, K. S. Adams, chairman, and Paul Endacott, president, announced.

The plant will be 20 miles south of the company's Spraberry plant, now under construction. Pembrook plant will be the approximate size and design of Spraberry plant. Although each plant was originally designed to process 60,000,000 cu ft of gas daily from Spraberry Trend wells, principally in Midland, Upton, Glasscock, and Reagan counties, expansion of Spraberry plant to a capacity of more than 150,000,000 cu ft daily is already under way and other plant facilities will be increased as the drilling of new wells warrants.

Plans also call for extension of the company's products gathering line to the Benedum plant from the Spraberry plant, 34 miles to the north. Phillips is 50 per cent owner of the Benedum plant, which will be equipped to handle 30,000,000 cu ft daily of additional gas from the Spraberry formation.

First of the new facilities is expected to operate late this year and all others in the early part of 1953.

PAD Tax Certificates Help Raise U. S. Refining Output

The Petroleum Administration for Defense has reported that through April it had recommended accelerated tax amortization for refinery construction that would increase the Nation's crude-topping capacity by 1,289,492 bbl a day and its catalytic cracking capacity by 922,795 bbl a day.

Small refiners, those who process less than 20,000 bbl a day of crude, had 9.86 per cent of the total crude capacity of the Nation, only 1.86 per cent of the catalytic cracking capacity. This is especially significant, J. Ed Warren, deputy petroleum administrator, reported, because small refineries are putting themselves in better competitive positions with refineries with cat crackers.

Antwerp Refinery Open

Anglo-Iranian Oil Company and the Compagnie Financiere Belge des Petroles S. A. (Petrofina) have officially opened their new 40,000-bbl a day refinery at Antwerp, according to an AIOC Newsletter. Cost of the new plant, which went on stream last October, is approximately $28,000,000.

Anglo-Iranian and Petrofina planned the first large up-to-date refinery in Belgium at the end of 1948. The refinery was to have had a capacity of 30,000 bbl per day, but after events in Iran, which seriously threatened Western Europe's supplies of petroleum products, it was decided to increase capacity to about 40,000 bbl a day. Output this year is expected to reach 30,000 bbl a day.

North Dakota Refinery Is Planned by Stanolind

Standard Oil Company (Indiana) has selected a site for a new 15,000-bbl a day oil refinery currently under consideration, at Mandan, North Dakota.

"Initial capacity of the projected refinery is planned for 15,000 bbl a day. The design will be such, however, that it can be expanded to run at least 30,000 bbl per day as crude production and market demand for products increase," S. A. Montgomery, general manager of manufacturing, reported.

"If the crude situation in the Williston Basin develops as anticipated, construction should begin early in 1953," Montgomery stated, " and initial operation will be scheduled in 1954."

The plant will include facilities for crude oil distillation, catalytic cracking, vapor recovery, finishing, and shipping, it was announced. Engineering work is now in progress.

Principal products made at the refinery will be White Crown and Red Crown gasolines, Standard heater oil, Stanolex furnace oil, and industrial fuel oil, Montgomery added.

Four Platforming Units Scheduled for Operation

A 3800-bbl per day Universal Oil Products' Platforming unit was placed on stream recently for Canadian Oil Refineries, Ltd., at Froomfield, Ontario. Other units scheduled to go into operation in the near future include a 4400-bbl per day unit for Atlas Processing Company at Shreveport, Louisiana; a 1500-bbl unit for Bitumen and Oil Refineries, Ltd., at Matraville, New South Wales, Australia, and a 900-bbl unit for Petroleum Specialties, Inc., at Flat Rock, Michigan.

The 900-bbl per day unit for Petroleum Specialties is the world's smallest Platforming unit, although at least one 500-bbl unit is projected.

Each of the units is designed primarily for motor fuel production. This will make 14 Platformers in operation.

API Issues New Compounds

The American Petroleum Institute has issued a listing of four compounds newly available as of July 1. A list of the 204 compounds now available may be obtained on request to Carnegie Institute of Technology, Attention of Frederick D. Rossini, Department of Chemistry, Pittsburgh 13, Pennsylvania.

Orders for API Standard samples should be accompanied with full payment in advance, listing name of compound, number of sample, size and number of units, price as below:

Standard sample number[1]	Compound		Amount of impurity[2] mole per cent	Volume per unit[3] ml (liq)	Price per unit dollars
	Formula	Name			
1018-5S	$C_{10}H_{20}$	l-methyl-cis-4-isopropylcyclohexane	0.20±0.09	5	35
1019-5S	$C_{10}H_{20}$	l-methyl-trans-4-isopropylcyclohexane	0.07±0.03	5	35
1020-5S	C_6H_{16}	cis-hexahydroindan (cis-hydrindan)	0.06±0.02	5	35

[1] The designation "-5S" following the sample number indicates a sample of 5 ml sealed "in vacuum" in a special Pyrex glass ampoule with internal "break off" tip.
[2] The purity has been evaluated from measurements of freezing points in accordance with the method and procedure of the American Petroleum Institute Research Project 6, as described in J. Research Natl. Bur. Standards 35, 355 (1945), and Anal. Chem. 20, 410 (1948), unless otherwise noted.
[3] Tolerance approximately ±10 per cent.

Lion Announces Plans For New Chemical Plant

Lion Oil Company has let contracts covering the design and construction of its new Barton chemical plant to be constructed at Luling, Louisiana.

The new plant will be situated on a 1400-acre site on the west bank of the Mississippi River in St. Charles Parish about 14 miles upstream from New Orleans. Unless construction is delayed by unforeseen shortages of material and equipment, the new facility is expected to begin operation early in 1954. Products to be manufactured for sale include anhydrous ammonia and prilled ammonium nitrate. Nitric acid will be produced in an intermediate step. Natural gas for process material and fuel will be supplied by The Texas Company from nearby fields in Louisiana.

Chemical Construction Corporation is to be architect-designer of the installation and The Lummus Company will be the prime contractor for construction.

API Publishes Waste Gases Booklet

The availability of the fourth edition of Volume 2, *Waste Gases and Particulate Matter*, of the American Petroleum Institute's Manual on Disposal of Refinery Wastes was announced by the API Division of Refining.

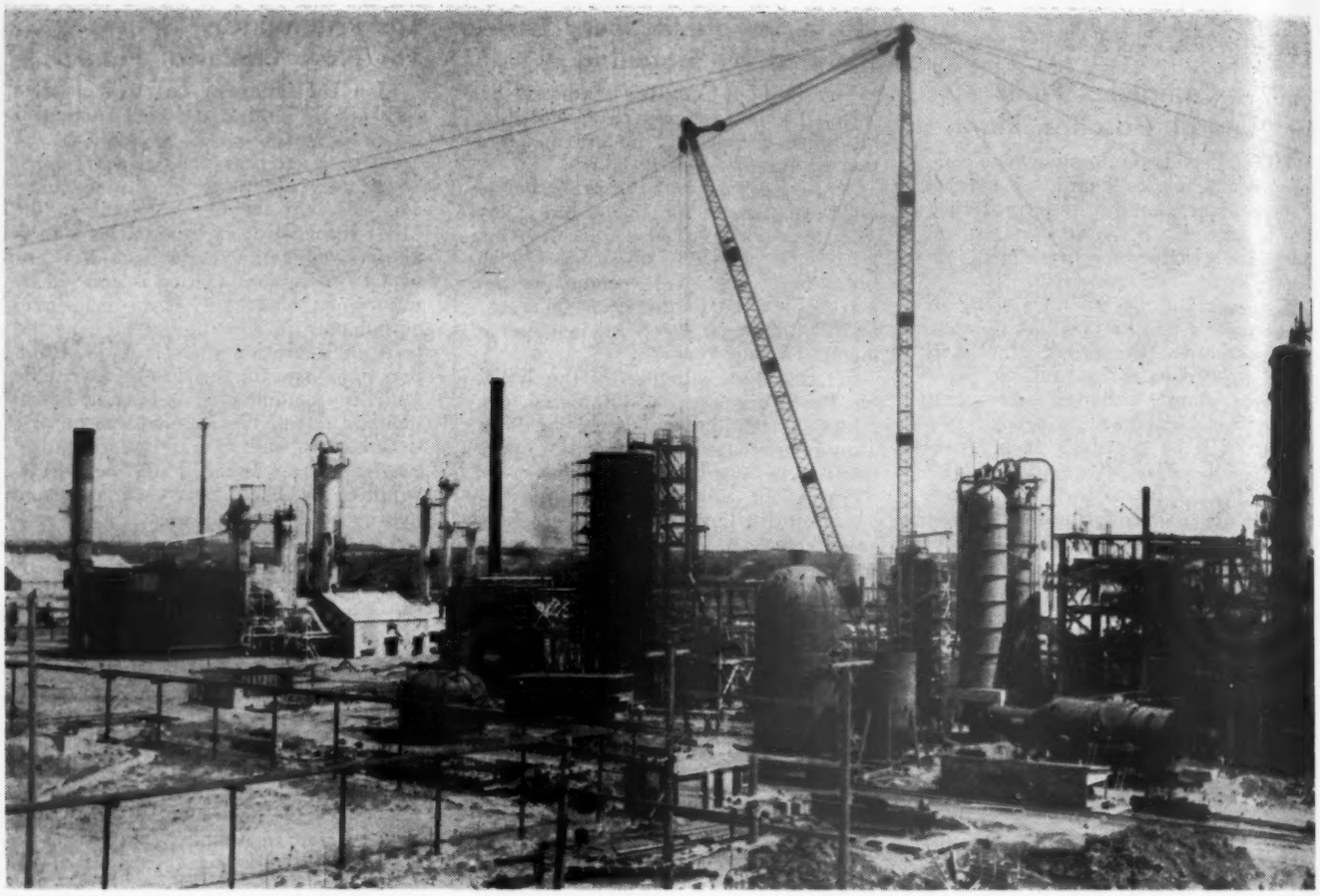
This publication deals with the disposal of waste gases and air-borne materials in petroleum refineries. It contains information, which, if applied by refiners, will help to prevent the escape of noxious or offensive gases and other air-borne wastes from refineries.

This publication is available through the Institute for $1.50.

More Plastic Capacity Set

Expansion of annual production capacity to more than a million pounds will be a fact when M. W. Kellogg Company completes its expansion program for Kel-F, fluorochloro-carbon plastic material, it is announced. This new plant will cost about $1,000,000 and is under construction at Kellogg's Jersey City, New Jersey, manufacturing center.

This new material was developed as a result of research to solve some problems of the atomic energy development at Oak Ridge, Tennessee, during World War II. The product has outstanding qualities in chemical inertness, plasticity, machinability, freedom from moisture absorption, electrical and temperature resistance, and is being used by molders and fabricators in the electronic and other industrial and commercial fields.



Edmonton, Canada, refinery of Imperial Oil in process of reconstruction.

Modernizing of Imperial's Edmonton Refinery Underway

The refinery now being installed by Imperial Oil, Ltd., at Edmonton, Canada, was built first at Corpus Christi, Texas, and during the War was transferred to Whitehorse, British Columbia, as part of the Canol Project, by the United States Government as a war operation. When the Leduc field was developed after its discovery in February, 1947, Imperial needed a refinery to process its field production. So the already much-travelled refinery was purchased by Imperial and moved once again, this time to Edmonton, Province of Alberta.

The major portion of the plant was transported by Imperial via the Alaska Highway. The remainder was sent to the West Coast, shipped to Vancouver, and thence via rail to Edmonton. Its official Canadian opening was in 1948, and the present throughput capacity is 25,000 bbl per day. The modernization plan now being carried out by Foster Wheeler, Ltd., is mainly for the installation of a catalytic cracking unit that should be completed by September, 1952.

Oil from the Leduc-Woodbend field goes via Imperial pipe line nine miles to Nisku, from which one stream goes to the Edmonton plant, the remainder going to the Inter Provincial Pipe Line and to Superior at the head of the Great Lakes.

British Queen (then Princess) Elizabeth and the Duke of Edinburgh visited this plant on the occasion of the recent Canadian visit of the royal pair. The installation serves northern Alberta, part of northern Saskatchewan and of British Columbia. Its superintendent is H. H. Moor.

Suntide Will Build $15,000,000 Refinery

Suntide Refining Company has announced plans to build a $15,000,000-refinery at Corpus Christi, Texas, scheduled for completion in the late summer of next year. The 25,000-bbl per day refinery will be built on a 134-acre site some six miles northeast of Corpus Christi, and will have fluid catalytic cracking, catalytic polymerization, and H. F. alkylation units, blending facilities, and adequate storage facilities, according to Floyd Martin, president of the company.

Original plans for the refinery were drawn up by Sunray Oil Corporation early this year. In May, Sunray, along with some outside banking interests, formed Suntide Refining to build and operate the refinery.

Martin announced that the refinery will be operated in conjunction with Sunray's deep-water crude oil terminal facilities and crude oil tank storage at Corpus Christi and the Sunray Coastal Pipe Line Company's crude oil pipe line gathering system from the Keeran field in Victoria County to Corpus Christi.

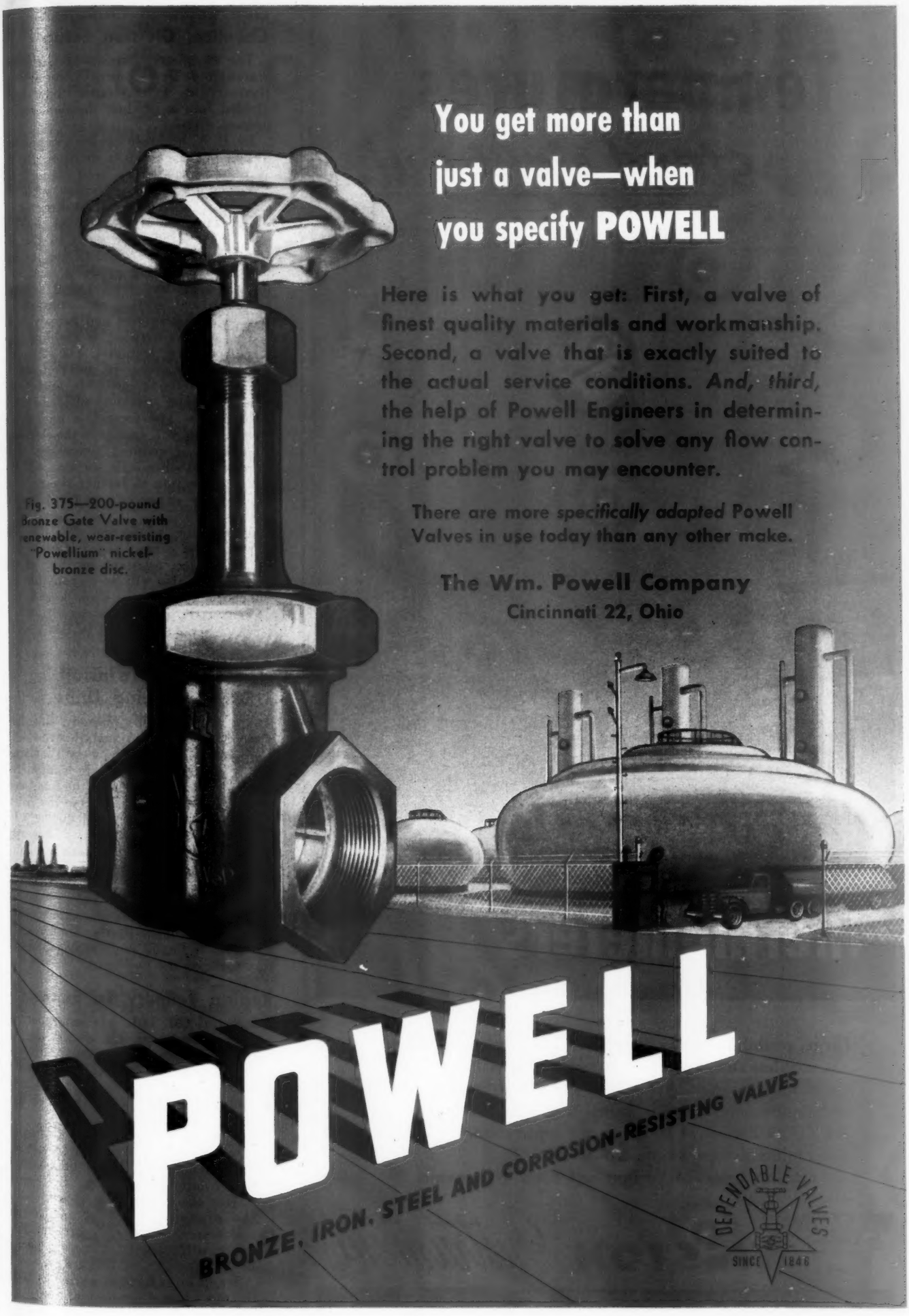
New Cation Exchanger

An analytical grade of a highly efficient cation exchange resin—Amberlite IR-112(H) — offering outstanding properties of high porosity, regeneration efficiency, and stability in hydrogen cycle operation, is now available from the Rohm and Haas Company, of Philadelphia, Pennsylvania. The new resin, which is a highly purified form of the recently announced IR-112 exchanger, can be used to advantage in operations involving adsorption of metallic complexes, extraction of large cations, and catalysis of organic reactions. At the same time, this nuclear sulfonic acid type exchanger possesses a high resistance to strong acids, strong bases, oxidizing and reducing agents, organic solvents, and to such conditions as elevated temperatures and mechanical attrition.

Gas Turbine Proves Worth On Ocean Vessel's Voyage

The gas turbine engine proved it is suitable for ocean vessels recently, when a British tanker completed a recent round-trip across the Atlantic Ocean. It may someday replace diesel engines in marine service.

The British *Auris*, a 12,250-ton tanker, is said to be the world's first merchant ship fitted with a gas turbine. Its recent trip was made from England to the Caribbean area and, although equipped with other engines, it used the gas turbine alone.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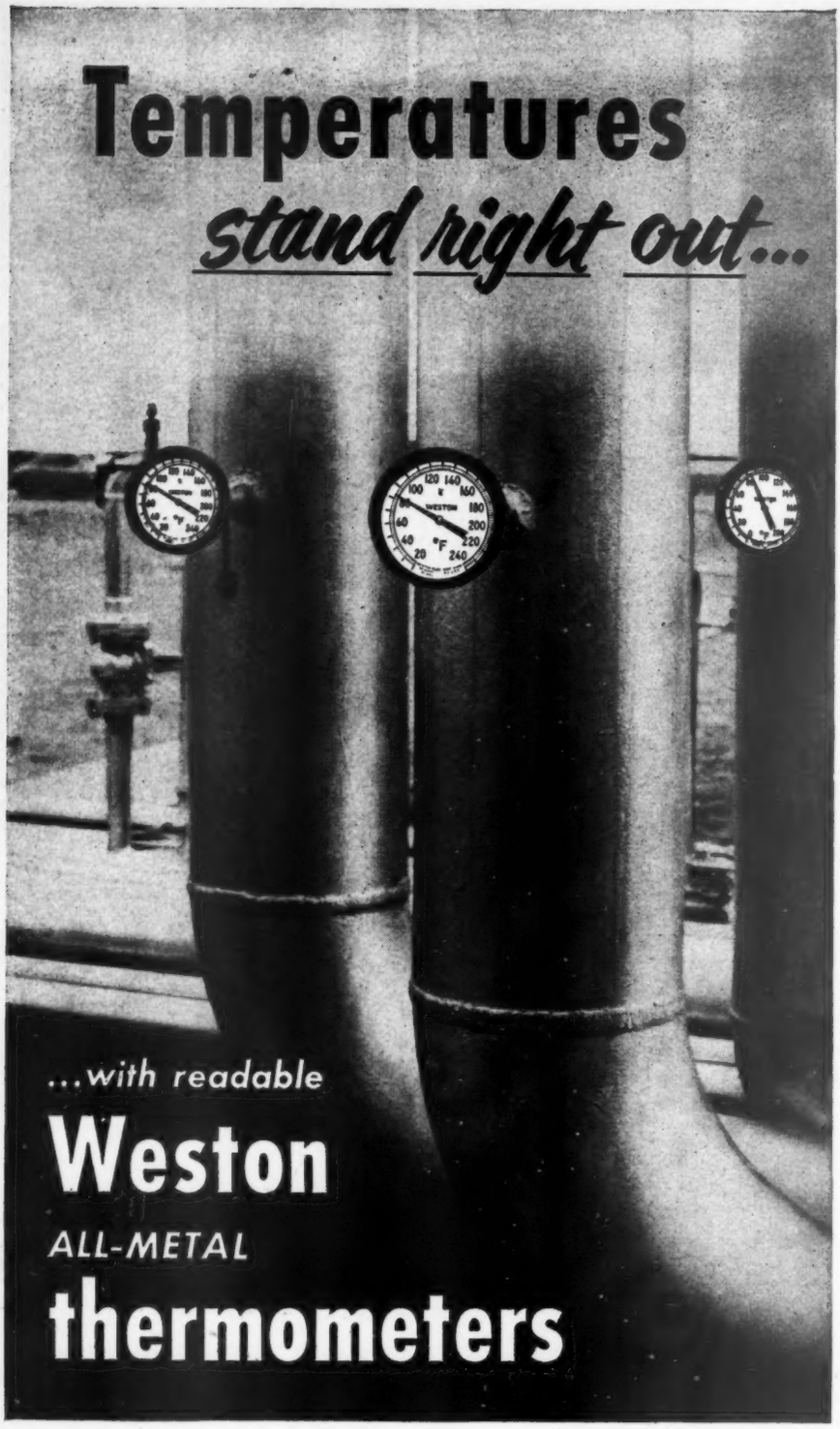

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Gulf Research Changes Chemical Division Setup

The chemistry division of Gulf Research and Development Company at Harmarville, Pennsylvania, has been divided into a product division and a process division.

Dr. H. A. Ambrose has been appointed director of the product division. Dr. C. W. Montgomery has been named director of the process division with W. C. Offutt serving as assistant director.

The activities of the product division will be devoted principally to the development of new products and to improving all existing products, and will include a product development section, an analytical section, an entomology section, and a service and supply unit.

The process division is divided into three primary sections: The first of these, refinery processes, will concern itself with refining methods and technology and the operation of large scale pilot plants. The second, a new processes section, will engage in the development of new refining processes. The third, a petrochemicals section, will direct its attention to further research in the rapidly expanding field of petrochemistry.

All activities of the new divisions will be under the general supervision of Dr. Jerry McAfee, assistant director of research, who also will be responsible for the coordination of the work done in the product and process divisions with allied research done elsewhere in the laboratory.

Anglo-Iranian To Install UOP Platforming Units

Anglo-Iranian Oil Company, Ltd., has announced plans to install five UOP Platforming units. Two of the Platformers will be built at Anglo-Iranian refineries in the United Kingdom, one will be built in France, one in the Aden area, and the fifth unit will be built in Australia.

Four of these new Platforming units will have a design capacity of 6000 bbl each per stream day, and the fifth is designed to charge 12,000 bbl per day.

Universal Oil Products, developers and licensors of the Platforming process has already begun engineering and design work on the five units.

Regina Refinery To Expand

Imperial Oil, Ltd., has announced a modernization program at its Regina refinery, Canada. Plant construction is expected to begin late this year and be completed by the spring of 1954. Clearing and preparation of the site has started.

The contract includes the building of a 7500 bbl-a-day fluid catalytic cracking unit, a vacuum distillation unit with a 9000-bbl daily capacity, and light ends plant for the recovery of gases.

The expansion program, to be carried out on the refinery's present 255-acre site, will raise the refinery capacity from 20,000 to 22,500 bbl a day.

Contract of expansion work has been let to the Fluor Corporation.

PERSONALS

Warren H. Kraft, Honolulu Oil Corporation, has been installed as president of the California Natural Gasoline Association for the fiscal year of 1952-1953. **Fred L. Hartley,** Union Oil Company of California, was elected to the office of vice president, and **E. R. Millett, Jr.,** was again appointed as secretary-treasurer.

Directors to serve for 1952-1953 are: **D. R. Arnold,** Superior; **M. L. Arnold,** Richfield; **F. W. Borden,** Sunray; **R. O. Boykin,** Fullerton; **A. H. Bradford,** West Coast Refining; **F. E. Bradley,** C.C.M.O.; **F. C. Brunner,** C. F. Braun; **C. L. Case,** Continental Oil; **L. V. Cassaday,** Lomita Gasoline; **F. J. Colton,** Tide Water; **D. W. Darnell,** Fluor; **F. F. Doyle,** Pacific Gas; **J. T. Doyle,** Shell; **H. L. Eggleston,** analyst; **R. C. Enderly,** Wilmington Gasoline; **P. E. Foote,** Petrolane, Ltd.; **M. L. Fort,** Pacific Lighting; **C. D. Gard,** and **R. D. Gibbs,** Union Oil California; **Wes Hammond,** Worthington Pump.

John Hancock, Hancock Oil; **R. W. Heath,** Signal Oil; **W. J. Heinz,** Ingersoll-Rand; **J. C. Herron,** Shell Oil; **R. J. Hull,** California Research; **C. L. Hutchings,** Tide Water; **M. W. Kibre,** General Petroleum; **William A. Kirk,** California Southern; **Grove Lawrence,** Southern California Gas; **H. R. Linhoff,** Richfield; **Paul Magee,** Ohio Oil; **S. F. Magor,** Superior.

P. S. Magruder, General Petroleum; **Geo. C. McLaren,** Standard Oil; **N. H. Mull,** Texaco; **H. W. Parmelee,** consultant; **H. M. Paulsen,** Norwalk; **W. W. Robinson, Jr.,** Texaco; **R. W. Todd,** Pacific Lighting; **R. S. Tulin,** Shell; **E. W. Walker,** Western Gulf; **L. K. Whittier,** Belridge; **D. M. Wolfe,** Standard, and **C. B. Kimberlin,** Seaboard.

Byron R. Johnstone has been elected as secretary of the American Petrochemical Corporation, and **John D. Snakenberg** has been appointed plant manager.

Johnstone has been associated with Cities Service since 1928, during the last five years as secretary of Cities Service Research and Development Company. Snakenberg has been a member of the Cities Service organization since 1923 and was manager of the Cities Service East Chicago refinery from 1947 to 1950. Since 1950 he has been associated with the Cities Service Petroleum, Inc., in New York, as assistant chief engineer of the manufacturing division.

American Petrochemical Corporation is jointly owned by Cities Service and Firestone Tire and Rubber Company.

Stewart S. Kurtz, Jr., has been named technical associate in Sun Oil Company's research and development department, it was announced by Dr. J. Bennett Hill, director of the chemical and engineering division.

Kurtz will move to department headquarters at Marcus Hook as a staff assistant to Dr. Hill.

Since 1942 Kurtz has served as manager of the company's chemical research laboratory at Norwood, Pennsylvania. He will be succeeded in this position by **Dr. C. L. Thomas.**

Kurtz took undergraduate and graduate degrees at Harvard University and joined Sun's research staff as a chemist in 1935.

Dr. Thomas, new manager of the Norwood Laboratory, is known in the oil industry for his publications and patents. He was director of research and development for the Great Lakes Carbon Corporation for six years before joining Sun in 1951.

R. H. Gardner, veteran of 33 years employment with Sinclair Oil Corporation, has been promoted to the newly created position of research associate. Gardner joined Sinclair upon being discharged from the Army after World War I. His first assignment was at Sinclair's East Chicago refinery, where he remained for approximately 12 years. He has been connected with the lubricants research division for approximately 16 years, during which time he has been instrumental in many new developments and processes, which Sinclair has put into operation. Primarily, Gardner's work at Sinclair Research Laboratories, Inc., has dealt with lubricating oils and greases in the fields of research, development, and application.

M. R. Fairlie has been promoted to director of lubricants research for Sinclair Research Laboratories, Inc. Fairlie formerly held a position of assistant director of lubricants research for Sinclair. He began his career with Sinclair at their East Chicago refinery as a chemist in the experimental laboratory some 25 years ago. He has been connected with lubricants both in development and research for the past 18 years.

Harluf C. Petersen has been elected a vice president of Freeport Sulphur Company by the company's board of directors. Petersen is a graduate of the Minnesota School of Mines. He became associated with Freeport Sulphur Company in 1934 at the Grand Ecaille, Louisiana, mine. After working in the company's production operations, he became superintendent of land and exploration. When Freeport began the oil and gas field in 1949, he was put in charge of the program, with headquarters in Houston, Texas, where he now lives.

Edward J. Tully, superintendent of the Brooklyn Grease and Compounding department of Socony-Vacuum Oil Company, Inc., was honored by his fellow employees at a foremen's dinner in the Hotel St. George, Brooklyn, New York, for his 50 yr service with the company.

Tully began his career in 1902 as an office boy with Blissville Cooperage, part of the old Standard Oil Company of New York, a Socony-Vacuum predecessor. He worked his way up to the position of chief clerk and was transferred in 1928 to the company's Brooklyn packaging operation as assistant superintendent.

J. W. Smith has been promoted to superintendent of Continental Oil Company's refinery at Glenrock, Wyoming. Former assistant superintendent of Conoco's refinery at Denver, Colorado, he succeeds the late Paul L. Rawdon, who died June 17. **R. W. Broadhurst,** former resident engineer at Ponca City, will succeed Smith as assistant superintendent at Denver.

Smith has had nearly 30 years of experience in refinery operations. He joined Conoco in 1923.

Broadhurst joined Conoco in 1941. after two years as an analytical chemist in Conoco's manufacturing department at Ponca City, he was transferred to the Denver refinery as resident chemist.

Warren H. Kraft

Fred L. Hartley

Byron R. Johnstone

John D. Snakenberg

▸ **Robert L. Kiehn** has been promoted to maintenance supervisor and **Charles W. Harrison** to shift supervisor at Deep Rock Oil Corporation's Cushing, Oklahoma, refinery. Kiehn joined Deep Rock in 1948 after graduating from Oklahoma A & M College. He was maintenance engineer before his latest promotion. In his new position he will have charge of all refinery maintenance and repairs.

Harrison was formerly pilot plant chemical engineer at the company's research and development plant in the Cushing refinery. He is a graduate of Oklahoma A & M and joined Deep Rock as an assistant chemist in the refinery control laboratory in 1948.

▸ **Gerald J. Smith** has been elected to the board of directors of Catalytic Construction Company. Smith is manager of the estimating and cost control department and is responsible for preparation of all proposals and contracts. Smith is a graduate of Girard College. He joined Sun Oil Company in 1937 and was manager of expediting for Sun during the last war. He joined Catalytic when the company was formed in 1946.

▸ **Roy M. Owens,** chief project engineer, has joined Standard-Vacuum Oil Company as managing director of Stanvac's new refining subsidiary in Melbourne, Australia. The company's present small Altona refinery at Melborune is undergoing extensive expansion at an estimated cost of $30,000,000.

Gerald J. Smith

Jesse C. Howard, in charge of the operating group, also has joined Standard-Vacuum and will be manager of the Altona refinery.

Harold C. Rothe, in charge of the maintenance group, is on leave to assist Vacuum Oil Company, Ltd., organize and train a staff to take over operation of Vacuum's new refinery at Coryton, England, which is scheduled to go on stream late this year.

R. E. Redfield, manager of manufacturing for Socony-Vacuum Francaise, will return to the United States in August to become head of the maintenance group of the refinery engineering division.

Austin C. Brightman, assistant chief project engineer has been advanced to the position of project engineer, and **Edward T. Maples,** a group leader, will become assistant chief project engineer.

Roger VanZytveld, in charge of the construction of a TCC unit for Deutsche-Vacuum Oel, A.G., at Bremen, Germany, and **Thomas D. Owens** have been promoted to group leaders in the project engineering section.

Norman Lockwood, head of the maintenance department at Socony-Vacuum's Brooklyn refinery, has been transferred to the refinery engineering division as a project engineer.

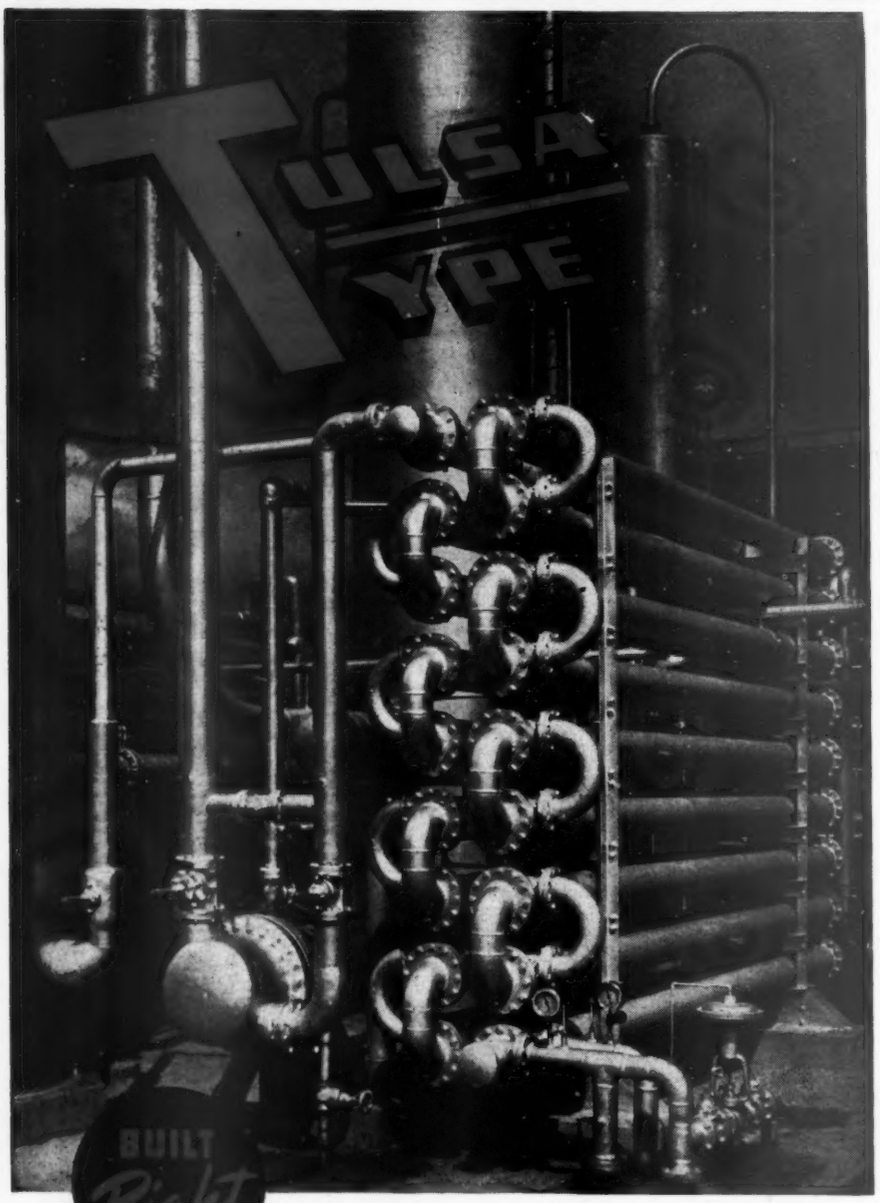
Vernon Loyd, in charge of maintenance at Socony-Vacuum's East Chicago, Indiana, refinery, has been transferred to the refinery engineering division as senior engineer in the maintenance section.

Robert J. Tummons has been promoted to head of the operating group, and **William G. Hard** has become Tummons' assistant.

Urban H. Wagner, senior process engineer, has joined Standard-Vacuum as assistant chief process engineer in the refining coordination department in New York.

James P. Shambaugh, head of the process promotion section, has been transferred to the process promotion section of the research and development department, in New York, to assist **A. V. Danner** handling licensing activities of Socony-Vacuum.

P. J. Wolfe, assistant head of the economics evaluation section, has been promoted to head of the process promotion section, and **D. A. Hermanson** has taken over Wolfe's duties in the economics evaluation section.



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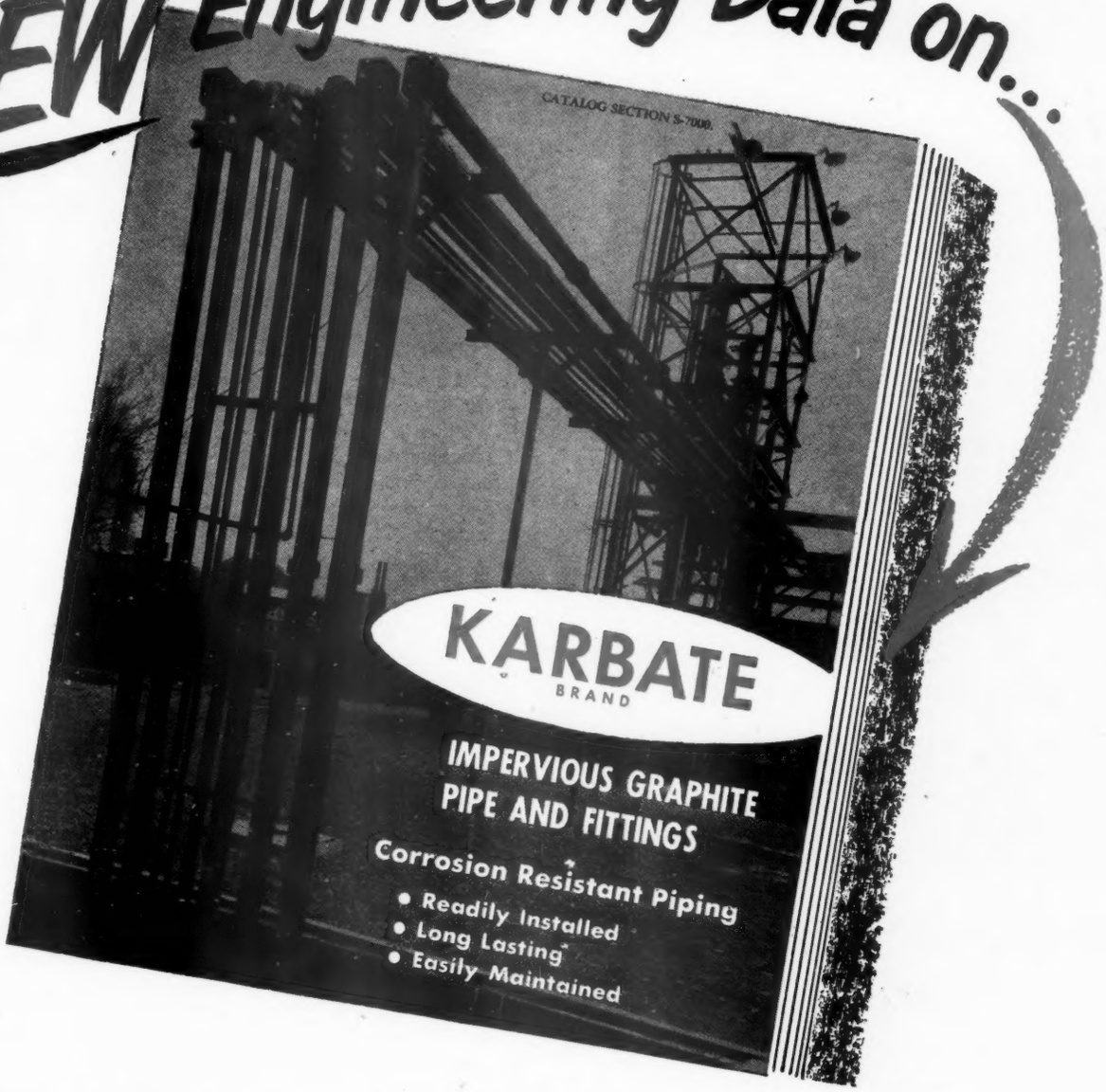

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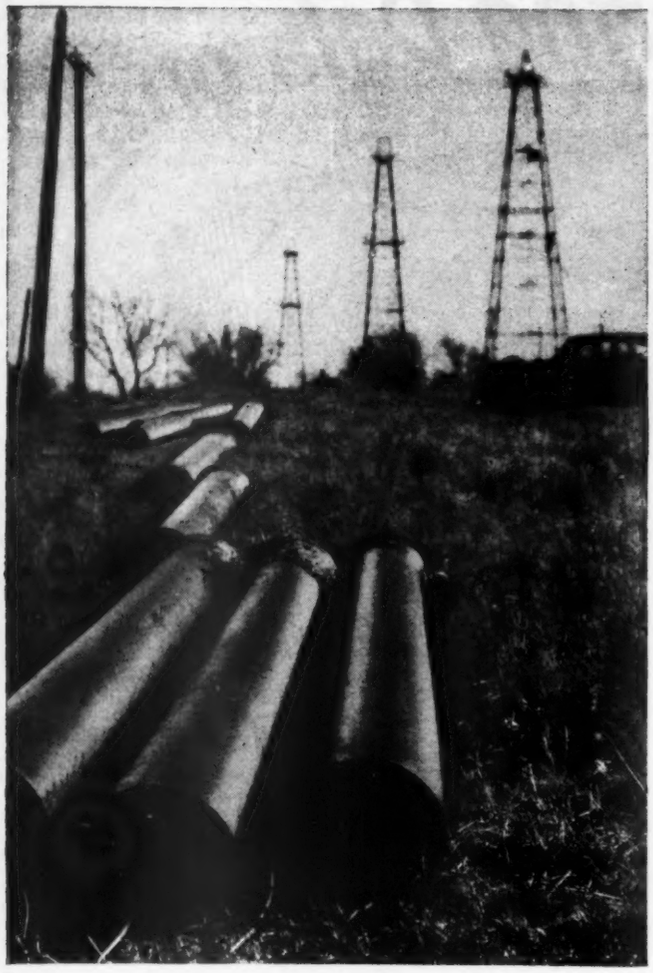

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CAST IRON PIPE
FOR LONG LIFE AND ECONOMY

On hand to note the milestone in Ethyl's increased productive capacity were: R. B. Thacker, Sinclair assistant superintendent; Wallace F. Armstrong, Ethyl plant manager; J. D. Seifer, operating superintendent, Sinclair; Parker Kendall, assistant general manager of refineries, Sinclair; R. W. Green, foreman, Sinclair's cargo and terminal department; Howard J. Gerber, Ethyl, sales representative; C. C. Stovall, assistant foreman, Sinclair; and Clinton W. Bond of Ethyl, general manager of manufacturing.

First Antiknock Compound Shipped from Plant

The first shipment of antiknock compound from the new Ethyl Corporation manufacturing plant in Houston, Texas, was delivered to the local Sinclair refinery recently. In noting the production milestone, Sinclair and Ethyl officials were on hand to inspect unloading operations at the refinery on Monday, June 16. The tank-car shipment contained 6000 gal of antiknock fluid weighing 77,500 lb.

The new Ethyl plant on the Houston Ship Channel was virtually completed in late April, and is expected to be in full production in July. One of the largest plants of its kind in the world, it covers 80 acres and is designed to increase Ethyl's manufacturing capacity by about one-third.

Wulff Acetylene Process Is Licensed

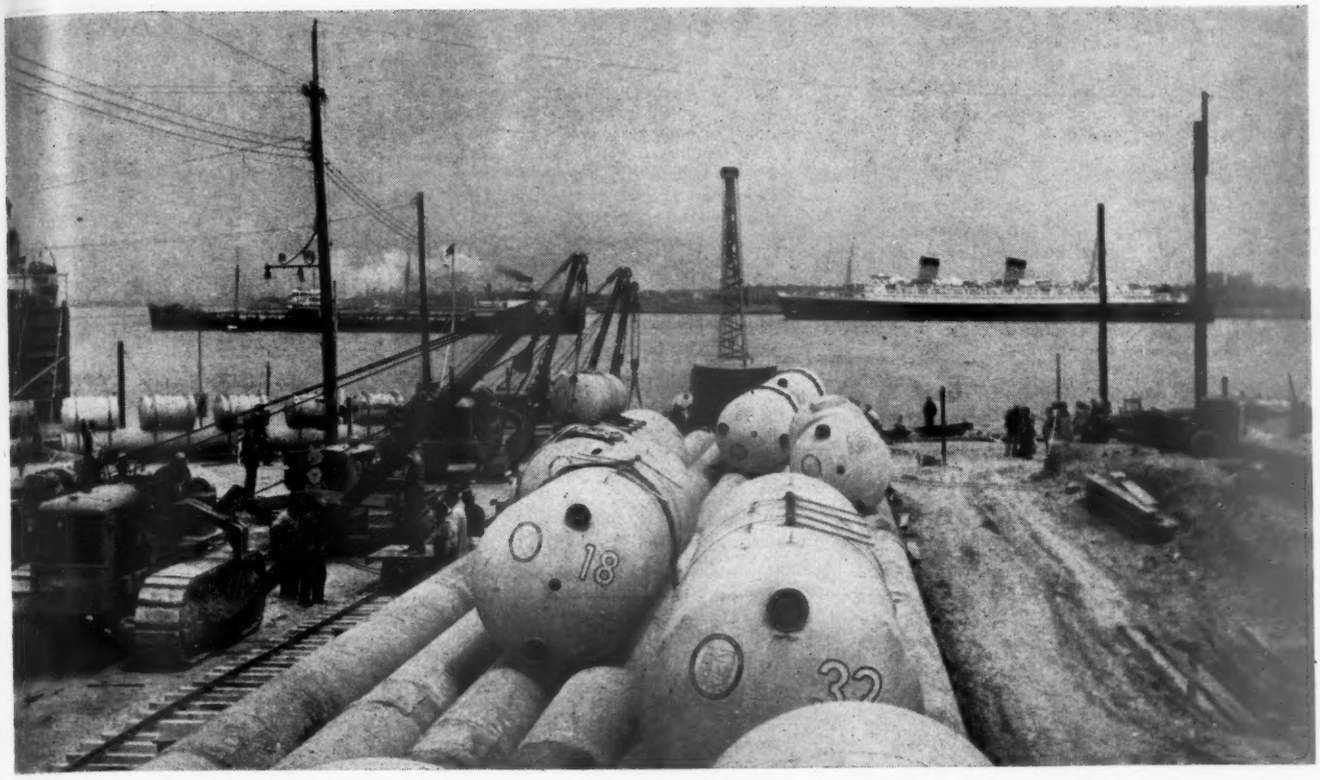
Agreements have been completed between Wulff Process Company and Fluor Corporation, Ltd., The Lummus Company, and Girdler Corporation, by which these three companies are permitted to design and construct plants for the application of the Wulff process for the production of acetylene and ethylene, The Fluor Company announces. Wulff Company is prepared now to license the process.

This process utilizes natural gas, ethane, propane, butane or "any L.P.G. mixture" as feed stock to produce low-cost acetylene. Plants as small as one ton of acetylene per day, or as large as 100 tons per day are practicable, it is said. The process may produce also ethylene or both products together, it is understood. The Wulff Company has been operating for 18 months a commercial-size pilot plant at Maywood, California.

Carbon and Carbide Plans Petrochemical Plant

A new petrochemicals, plastics plant is to be built by Carbide and Carbon Chemical Corporation, J. G. Davidson, president, has announced. The new plant will be situated in Calhoun County, Texas, eight miles northwest of Seadrift. A DPA Certificate of Necessity has been issued for the construction.

Ethylene and ethylene oxide are two of the major intermediates to be made at the plant. Ethylene will be polymerized to form polyethylene resins, which are used widely in defense manufactures especially as insulation for electric wire. Brown and Root engineering firm of Houston will construct the plant, and construction will start this fall, employing at the peak about 4000 men. Project manager will be Frank C. Kuich, project engineer, John C. Sillin, with J. H. Ware engineer in charge of construction for Carbide. About 750 employes will be required to run the plant when it is in full operation. This plant is the second on the Gulf Coast for Carbide, the largest of which being the chemical plant at Texas City.



S. S. *Queen Elizabeth* sails through the Narrows while Transcontinental's 36600-ft line is being pulled from Staten Island to Brooklyn.

EXCLUSIVE

A Pipe Goes to Brooklyn

First natural gas pipe line to cross the Narrows terminates a year's planning and construction

STANLEY OWENS

On June 24, 1952, a young construction engineer named Sammy Collins dove off the 92nd Street, Brooklyn, seawall into the cold, rushing waters of The Narrows. When he surfaced he held in his hands the guide cable on the end of a 6400 ft, 26 in. diameter concrete covered steel pipe that had just been pulled across from the Staten Island shore. Attaching this to a cable he signalled for the line to be drawn taut. This action raised from the waters and secured to the Brooklyn shore the first

Sammy Collins swims ashore after diving into the swirling waters of the Narrows to locate and guide the landing. Note pulling cable attached to swivel joint on war-head. Fastened above and tied back is a second cable to be used in the event of a break.

natural gas pipe line to have crossed The Narrows. It marked the advent of the longest and deepest submarine pipe line crossing, which became an integral part of the Transcontinental Gas Pipe Line Corporation system.

This signalled the successful termination of about one year of intensive planning and construction work on this project which was built under the direction of the Transcontinental engineering department. Raymond H. Crowe, chief engineer, was the guiding factor in the planning and direction of this work. Jim Crawford, assistant chief engineer. acted as resident engineer for this job and Carl Whitaker was assistant construction superintendent. Samuel Gallucci and Sons of Long Island, New York, supplied the men and equipment. The Collins Construction Company of Victoria, Texas, provided the flotation equipment. The cómplete story of the construction of the crossing is shown in the illustrations with this article.

Through The Narrows pass vessels

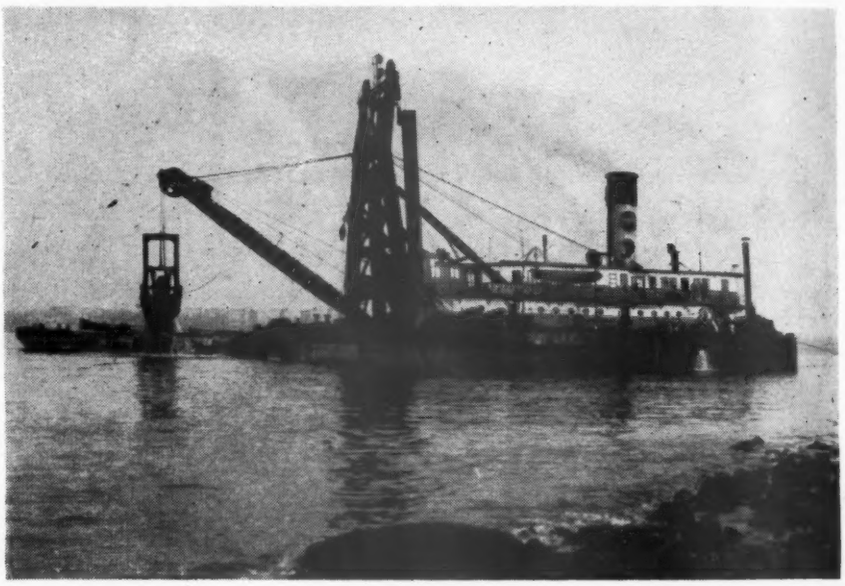
The Author

Stanley Owens

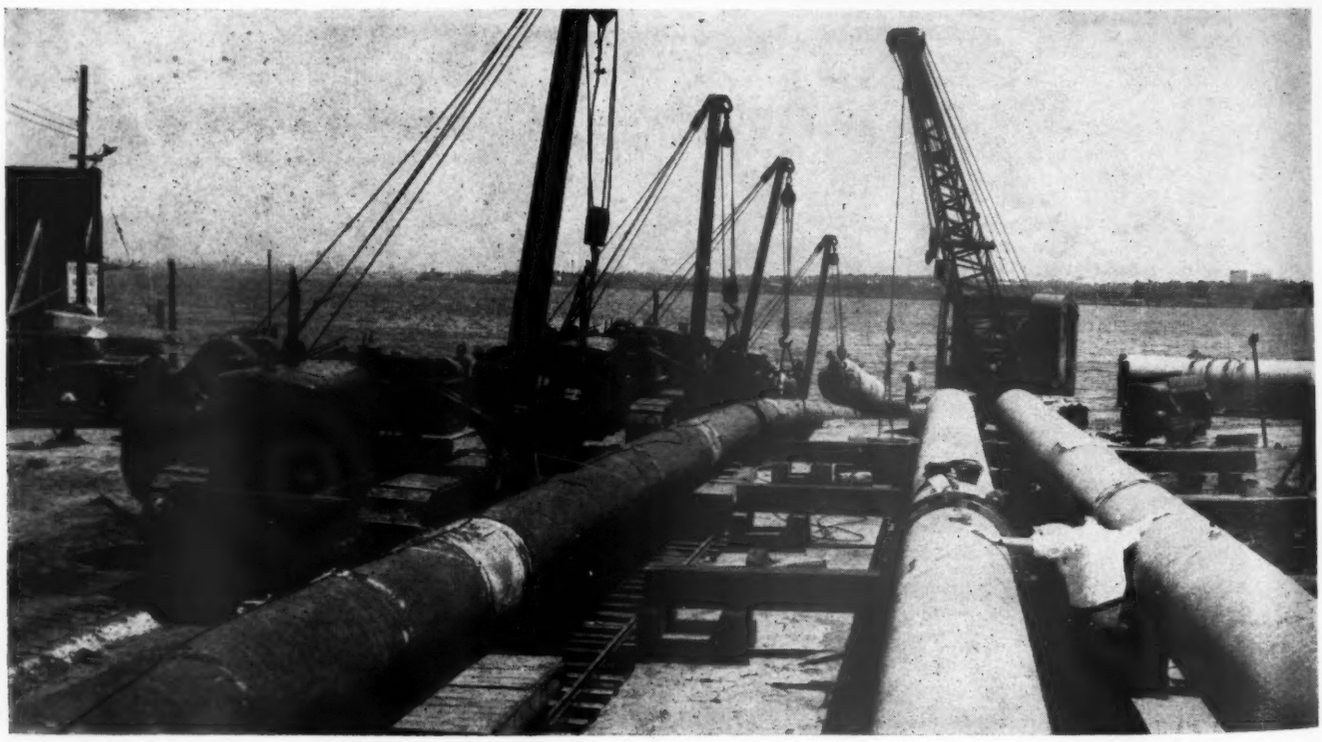
Stanley Owens, director of safety, Transcontinental Gas Pipe Line Corporation, has been associated with the two largest natural gas transmission companies for the last eight years. As safety director for the Portland Cement Association, he had charge of safety and insurance of cement plants in 27 states.

Shortly after Pearl Harbor, he was appointed a member of the War Training Staff of the Illinois Institute of Technology. Subsequently, he was placed in charge of the protection of war plants in the Sixth Service Cómmand area against sabotage, fire, and accident. For three years he was resident then chief engineer of heavy construction work, including tunnel projects driven under air pressure, by private construction contractors.

His many contributions on the technical aspects of safety as applied to large-diameter gas pipe line construction and operation have appeared in *The Petroleum Engineer* and other trade publications.

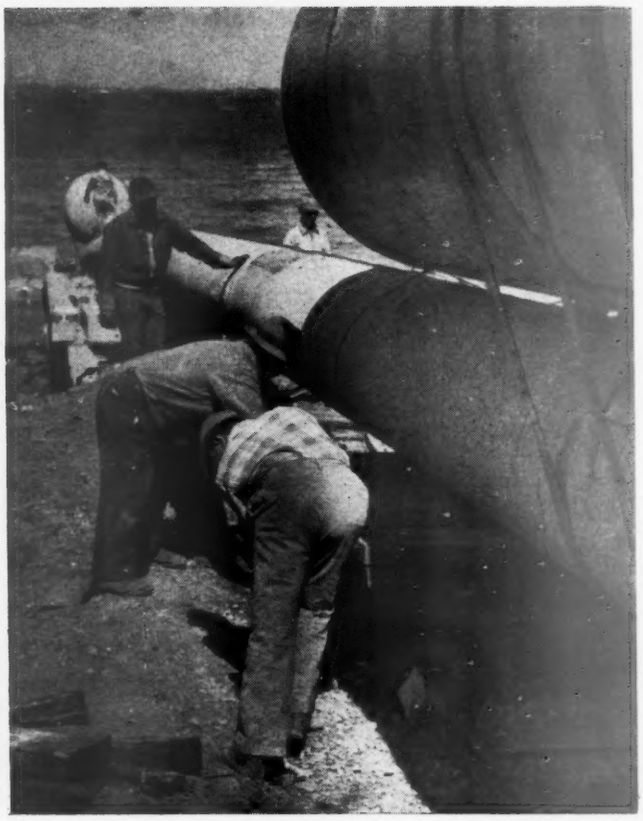


Taking 11-cu yd bites this single clam-shell dredge, working 24 hrs a day for about 5 months, dug a ditch across the 90-ft deep waters of the Narrows, 25 ft below the bottom. The ditch was wide (20 ft at bottom and 40 to 300 ft at top). Width accommodates not only Transcontinental's 24-in. pipe line but also two 8-in. welded, concrete-jacketed electrical conduits of the Consolidated Edison Company of New York. About a half a million cubic yards of clay, gravel, sand and boulders were removed to barges, which had to be towed to sea and dumped.



Four closely spaced side-boom tractors are used in the launching operation.

Pontoons were spaced to reduce the weight of pipe in air from about 550 lb per foot to about 10 lb per foot in salt water. The small pontoon on top, when released, floats to the surface. By pulling on rope attached to it, steel cutters release pontoon from pipe, whereupon it immediately surfaces. Because of extreme depth of water (104 ft) in which pontoons would be, it was necessary to pressurize them to about 40 psi.



View showing pipe moving out onto launcher. Track here lowers and the supporting car shown removes itself by gravity. Note steel bands holding pontoon onto cradle resting on pipe.

View of the entire pipe line crossing equipment, just prior to pulling the first of eight 800-ft sections. The "war head" to which the pulling cable was fastened is shown on the forward end of the first section, which at this stage is mounted on cars on the narrow gage launching track. X-ray technicians may be seen completing X-ray of each weld in the adjoining pipe. Note night caps on end of each of the other 6 sections.

Aerial view showing final 800-ft section of pipe being pulled into the Narrows. One of the pontoons is just dipping into the water after having passed over the "hydro-pneumatic multi-differential self-stabilizing pipe launcher." Narrow gage railroad tracks, sloping from under pipe to left of foreground, carry supporting cars away as pipe rides up on launcher.

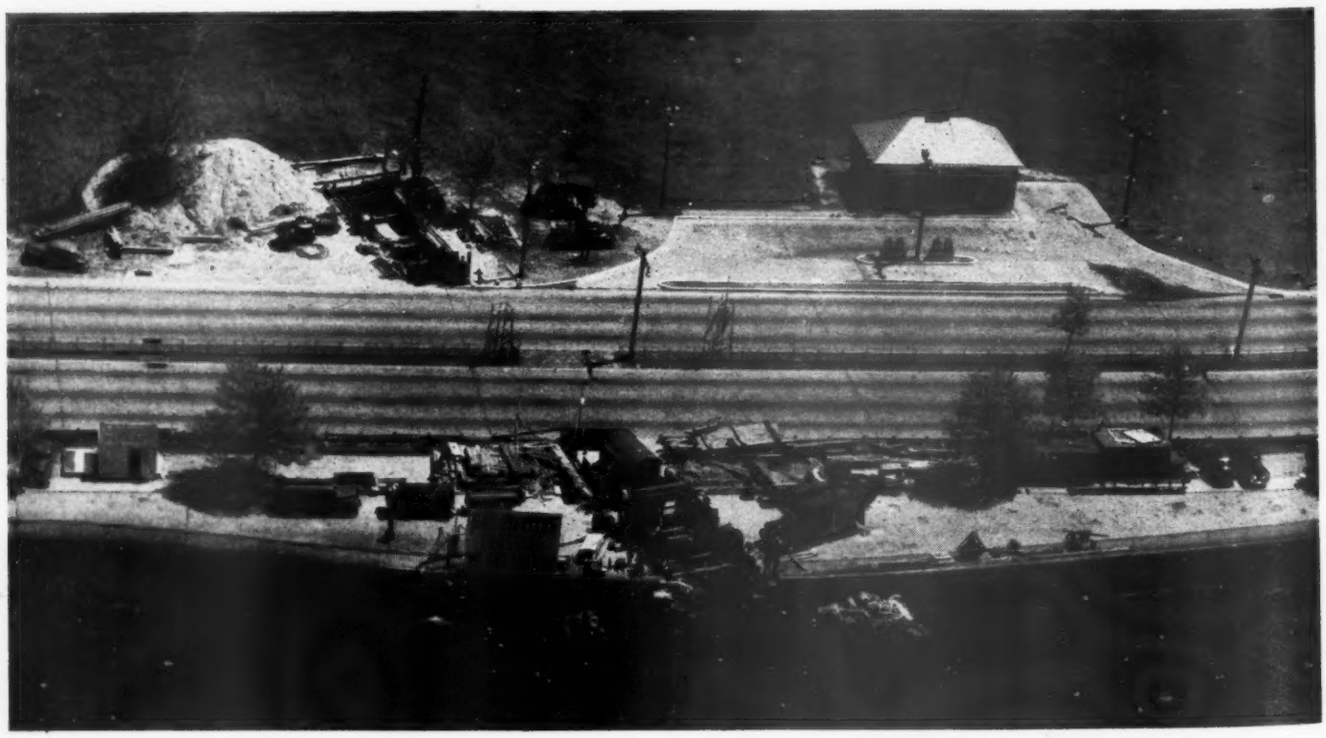
from the far corners of the globe to the biggest port in the world, New York City.

Included in the parade of ships across this construction work were such famous boats as *The Queen Mary* and *Queen Elizabeth*, the new S. S. *United States*, and all the proud liners carrying passengers to and from the old world.

The largest battleships of the Navy, the U. S. S. *Missouri* and the famous aircraft carrier U. S. S. *Wasp*, crippled as she was, were observed sailing over the crossing operations.

The incident of this crossing of these operations by the U. S. S. *Wasp* was interesting. The announcement in the press that the crippled *Wasp* was proceeding to New York Harbor with 1800 ft of her anchor chain and other wreckage dragging on the bottom created consternation among the engineers responsible for the job. Another crisis was passed when the safety director, after a hurried conference with the captain of the port of New York and the U. S. Navy operations office, issued a statement that the anchor chain and any other projecting wreckage from the *Wasp* would be burned off by divers when she anchored off Gravesend Bay (below our construction operations) to unload ammunition.

As the pipe reached about mid-way across the Narrows the "*Big Mo*," one of the largest battleships in the world, approached operations. Through radio contact and the cooperation of the various government agencies concerned, the captain swung this ship to the opposite side of the channel to minimize any interference with the construction work. In view of the fact that her entourage included a submarine, two destroyers,



Aerial view of Brooklyn landing showing (upper rear) excavation in which lies the 425,000-lb winch—connected by 6-ft steel pipe tunnel to landing location at water level on cut-out section of stone-breakwater (lower front center). Pipe line warning sign is 20 ft by 30 ft; letters average 30-in. high. Sign electrically lighted. Note range lights directly over cable pipe near water's edge.

Lining up another 800-ft section preparatory to welding. Somastic and concrete covering over the weld will be rushed into place as soon as the weld has cooled. Then, all but a few feet of the section will be pulled ahead into the water.

Looking toward Staten Island shore from above winch pit on Brooklyn side. Tunnel under parkway in center. Exhausts from diesel power unit and winch (in pit) extend in center foreground. Winch has 425,000 lb pulling capacity.

Left to right: Transcontinental's Jim Crawford, assistant chief engineer and resident engineer; partially hidden, Bob Topper, assistant chief engineer, and Raymond H. Crowe, chief engineer, direct the pulling of the crossing by radio and telephone.

Lt. Robert E. Lee, U. S. Coast Guard, Port Security Unit, New York City, makes a safety inspection of the marine construction operations in the Narrows with Stanley Owens, the author.

and various other naval tenders, this action relieved our construction supervision of a lot of worries.

One of the major problems on this job was created by the requirement of the U. S. Army Engineers that river traffic on The Narrows must not be interrupted and that shipping must by all means be protected from accident and damage. Because of the problems posed by these requirements, the director of safety and the staff of the safety department of Transcontinental then entered into the work of the over-all problem of protecting shipping, the trench, and pipe for the duration of the job.

Permits were arranged for from the Aids to Navigation section of the U. S. Coast Guard and range lights were installed on both shores to identify the exact location of the trench being dug.

Permits and arrangements for U. S. Coast Guard Notices to Mariners were completed. These notices are published by the U. S. Coast Guard and sent to all shipping offices in this territory. These are followed up by radio warnings to all shipping concerning the construction.

Special press notices were published in advance of, and during the crossing operations covering notifications to shipping interests in advance of the date of the pulling of the cable across the bottom of The Narrows.

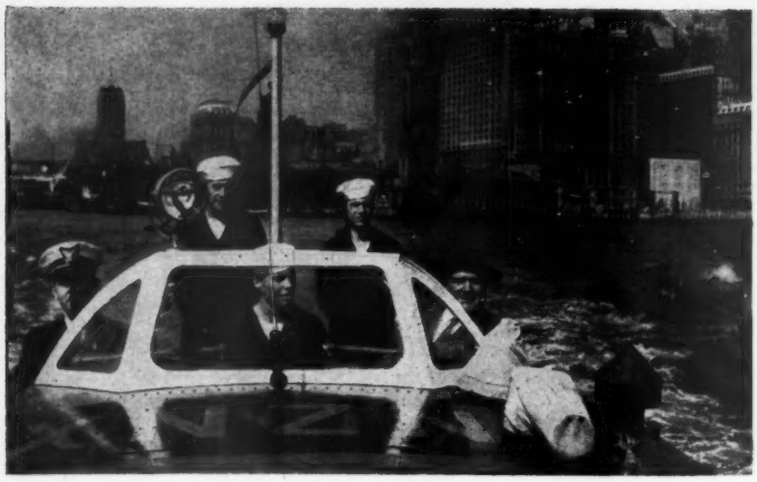
Large signs 15 ft by 30 ft with 30-in. letters and electrically lighted announce from each shore:

"Pipe Line Crossing — DO NOT ANCHOR."

Two private patrol boats were hired and they patrolled the crossing 24 hr per day. These boats were equipped with large signs reading "Pipe Crossing—DO NOT ANCHOR." These signs were illuminated at night. Whenever an approaching vessel slowed down near the crossing the patrol boats would proceed to it and notify it of the construction under way.

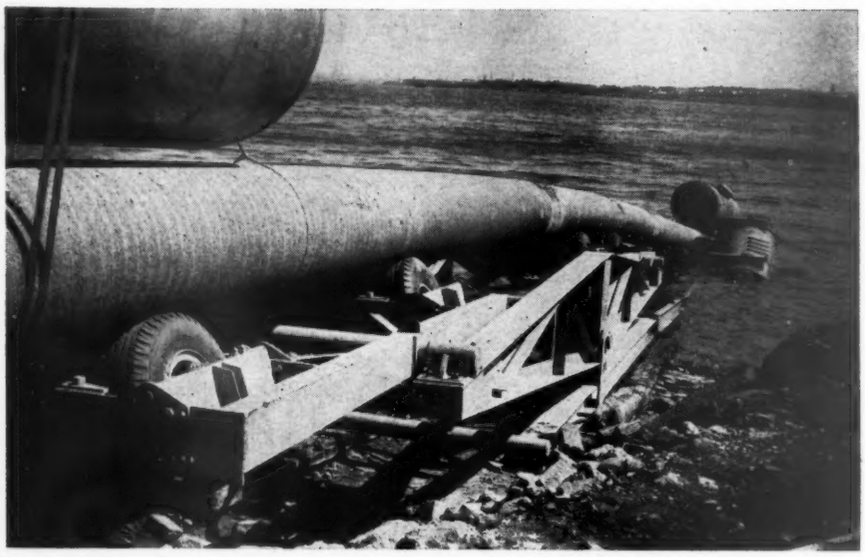
The U. S. Coast Guard patrol boats, during their regular trips, cooperated in effectuating the police power needed by the private safety patrol boats in the event of a pilot's refusal to anchor at a safe distance.

During each 24-hr period of construction operations, 8 separate U. S. Coast Guard patrols were made by two 40-ft Coast Guard cutters. Their regular patrol work was by special order ex-



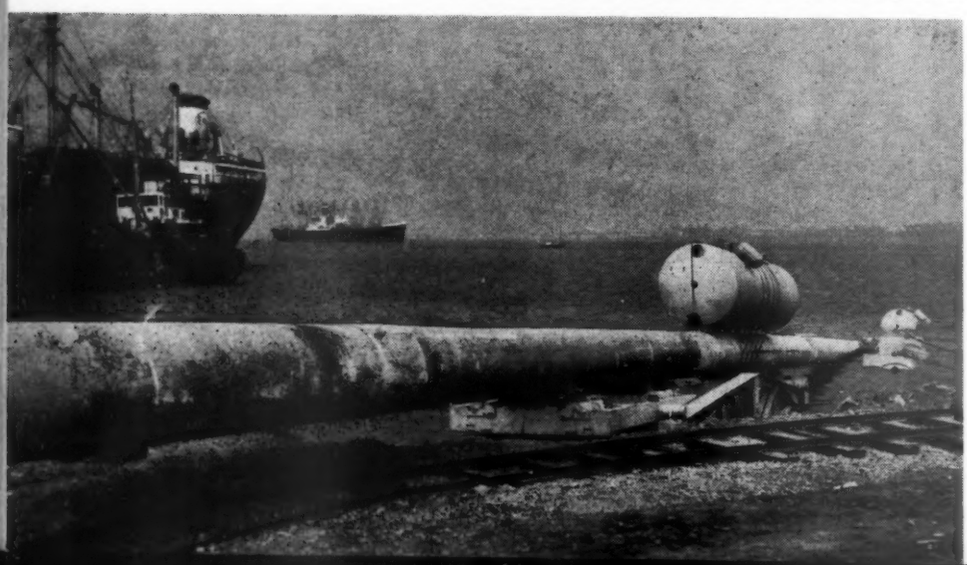
On board U. S. Coast Guard Cutter taking off from Battery on regular 6-hr patrol of Brooklyn shore line. During period of construction of Narrows pipe line, Coast Guard crews were alerted to give assistance where necessary to notify pilots of the hazard of dropping anchors in the vicinity of the crossing operations. Patrols were maintained along both the Brooklyn shore and the Staten Island shore on a 24-hr basis.

Sal Costa of Transcontinental using Geiger Counter checking radio activity for public safety during X-ray work on pipes in public street. The unusual safety sign displayed is a requirement of the Atomic Energy Commission, which controls use of radio-active cobalt.



The launching was accomplished by running the pipe over this hydro-pneumatic multi-differential self-stabilizing pipe launcher, invented by Samuel J. Collins. The pipe is supported by 18 10:00 by 15, 14-ply tires. Forward end is supported by two pontoons to control the height of launcher relative to tides.

View of pipe entering water over launcher. Brooklyn shore is visible in the distance. Note the safe distance away from the projected line of crossing that the cargo vessel has anchored (background). Track in right foreground carries cars to a safe clearance and out of working zone.



tended to include periodic visits to the pipe line crossing to protect shipping and the public safety. Each boat is manned by a bos'n mate, a seaman, and an engineer. The work went on in the heaviest weather in an effort to help keep ships from dropping anchors into the ditch or pulling the cable or pipe as it was pulled through the trench.

In the United States Coast Guard, Commander Carl H. Stober, chief, Aids to Navigation Section, Lt. Robert E. Lee of the Port Security office, Melvin D. Johnson, chief quartermaster in charge of the Anchorage Section and captain of the port, Captain W. L. Maloney, were all vitally concerned over the safety to vessels, crews, and passengers of shipping that would be using The Narrows during the construction phases.

Another cooperating agency was the U. S. Public Health Service in charge of the Quarantine Anchorage under which the crossing was located. A large percentage of ships using The Narrows are required to anchor here and be boarded and examined by U. S. Quarantine personnel.

In order to minimize the possibility of any of these ships dropping an anchor in the trench under the Quarantine Anchorage, arrangements were made with the New York, New Jersey, and Sandy Hook Pilots Association to the end that their pilots would not accidentally drop an anchor within 500 yards upstream or downstream of the submarine crossing construction. This prevented the cable or pipe from being "hooked" and pulled out of the trench and damaged.

Each of the above mentioned officers, Federal and Municipal agencies, met regularly with the director of safety of Transcontinental.

The resulting cooperation between these men and agencies and the safety department of Transcontinental established a safety record for this job. There was no interruption to river traffic, no damages incurred by any ships, and no injuries to the public. * * *

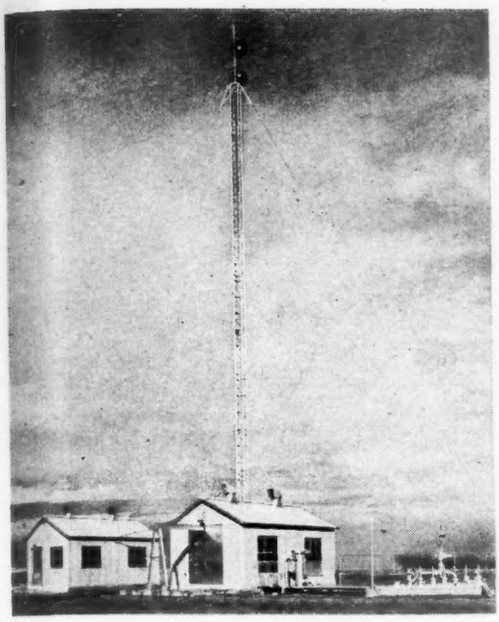


FIG. 1. Unattended booster station No. 41A (Pernell, Oklahoma) is operated by microwave from control 30 miles distant at Wynnewood.

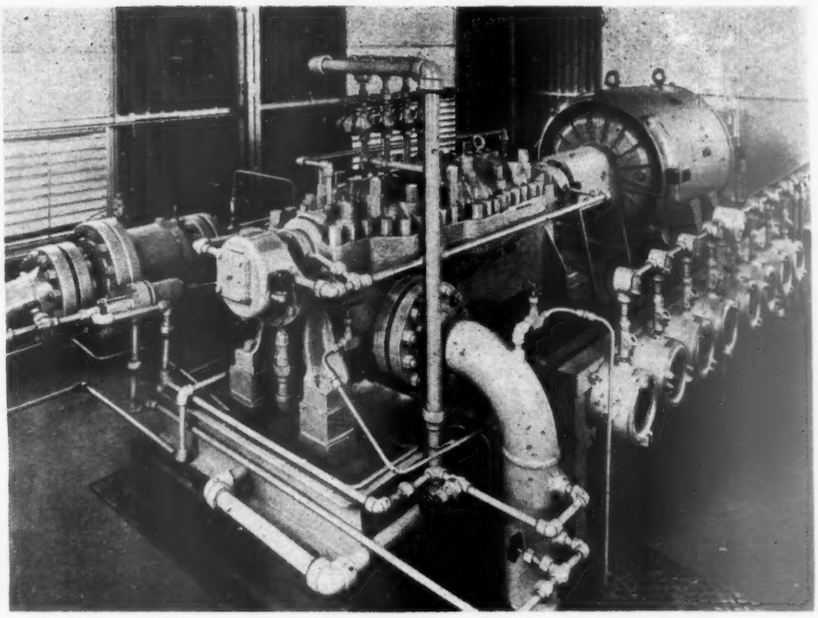


FIG. 3. Booster pump at 41A. (This is installed in building at right in Fig. 1.)

Pushbutton Operation of Booster Stations

Sunray supervises operation of remote stations by means of microwave radio

JOHN L. SALLADIN*

SUNRAY Oil Corporation, late in 1950, realized that its pipe line facilities were inadequate to handle expanding refinery operations. As larger pipe was not readily available, it was decided to increase line output by adding booster stations approximately midway between pumping stations. Remote-controlled, automatic stations were deemed the best solution.

Although the basic principles of unattended pump stations have been known for a long time, the daring application of known principles mark this project as outstanding and the first of its kind.

Equipment

Electric motors were chosen to operate the booster pumps as they are more easily adapted to remote control circuits, constitute a lower initial investment, and require less maintenance. On the basis of economy and dependability, 960-mc microwave equipment was selected to convey the controlling information. A wire-line system may be damaged during heavy storms, breaking control of the remote station.

Microwave radio-relay links permit automatic operation of booster stations, relaying to the main controlling station information on pressures, power, and equipment operation. Microwave also provides two-way channels for voice communication.

System Layout

Two boosters, situated near Pernell and Ada, are controlled from Wynnewood station. Another booster near Bearden is controlled from Allen. Antenna tower heights of 100 ft at Pernell, 350 ft at Wynnewood, 300 ft at Ada, and 170 ft at Allen and Bearden provide line-of-sight paths for the microwaves. The antennas, mounted at the top of these towers, utilize 4- and 6-ft diam, high-gain parabolas to give the waves directivity and power.

*Communications systems engineer, RCA Victor Division, Camden, New Jersey

FIG.2. Microwave, telemetering, and control equipment at 41A. Note emergency power generator at far left.

EXCLUSIVE

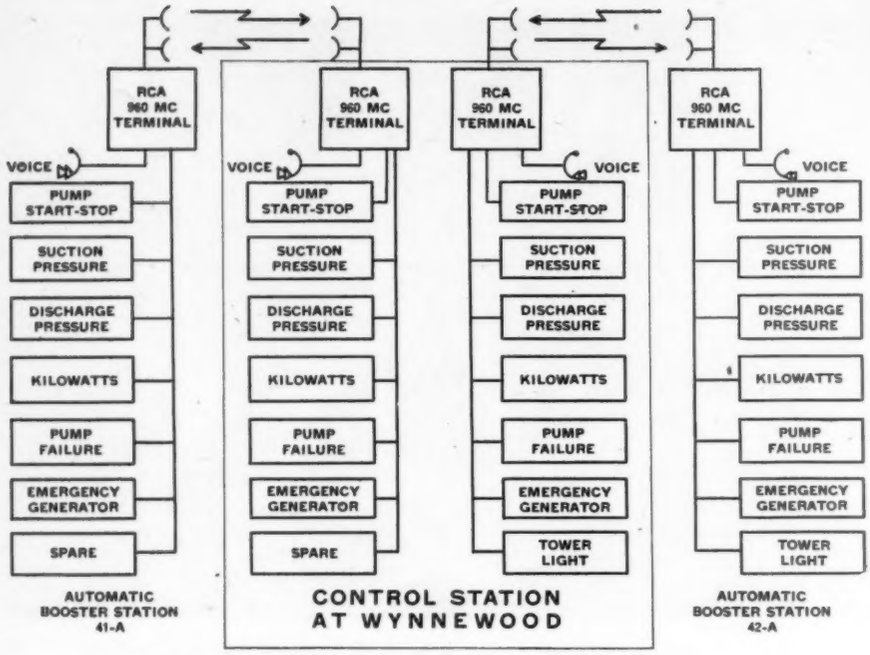


FIG. 4. Block diagram of microwave system designed for Sunray Oil Corporation.

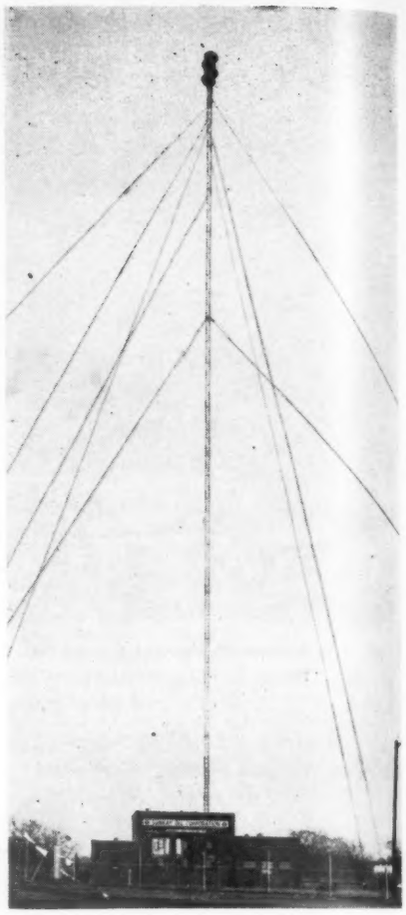


FIG. 5. Wynnewood control station.

Normal Operation

The remote stations are operated by the attendant on duty at the main station. A control desk in his office is equipped with recording charts actuated by telemetering equipment. A continuous record of suction and discharge pressures and kilowatt hours of power being used at the booster station is available at all times. In addition, lights on the control panel indicate equipment failure, tower light failure, and emergency generator operation.

To start a booster, the operator presses the "start" button at control desk. This switches on a tone oscillator whose output is applied to the microwave transmitter. The tone receiver at the booster station closes a relay to initiate the start sequence. When the motor-operated suction valve has opened, the main pump motor starts and simultaneously the discharge valve begins to open. After it has fully opened, the station is on the line.

The booster station can be shut down by pressing the "stop" button at the control desk. The pump stops and the discharge valve begins to close. When completely closed, the suction valve closes, and the station is off the line.

Emergency Operation

A selector switch has been provided at each booster station for local operation of pumps in event of prolonged failure of remote control equipment. If suction or discharge valves do not open completely, if suction pressure is not above a predetermined minimum, or if discharge pressure is not below a predetermined maximum, the station is automatically shut down. Discharge and suction valves then close in normal se-

FIG. 8. Coaxial feeder lines to microwave antenna at Wynnewood.

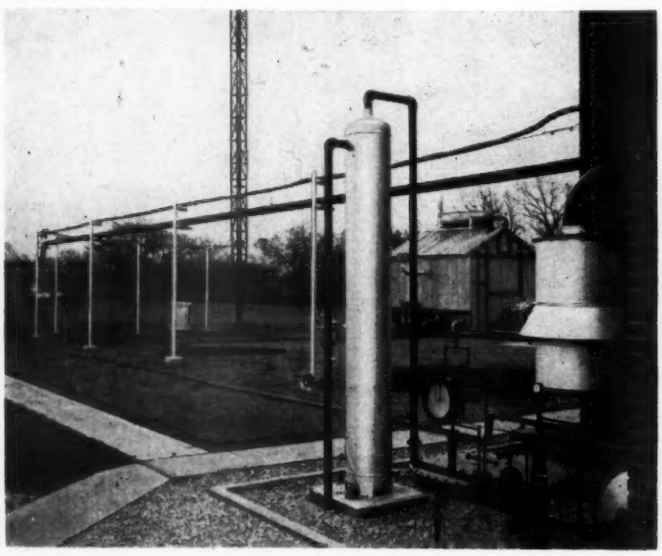


FIG. 6. Charles V. Bishop at control console, Wynnewood. Telemeter charts provide continuous record of performance at booster stations over a 24-hr period.

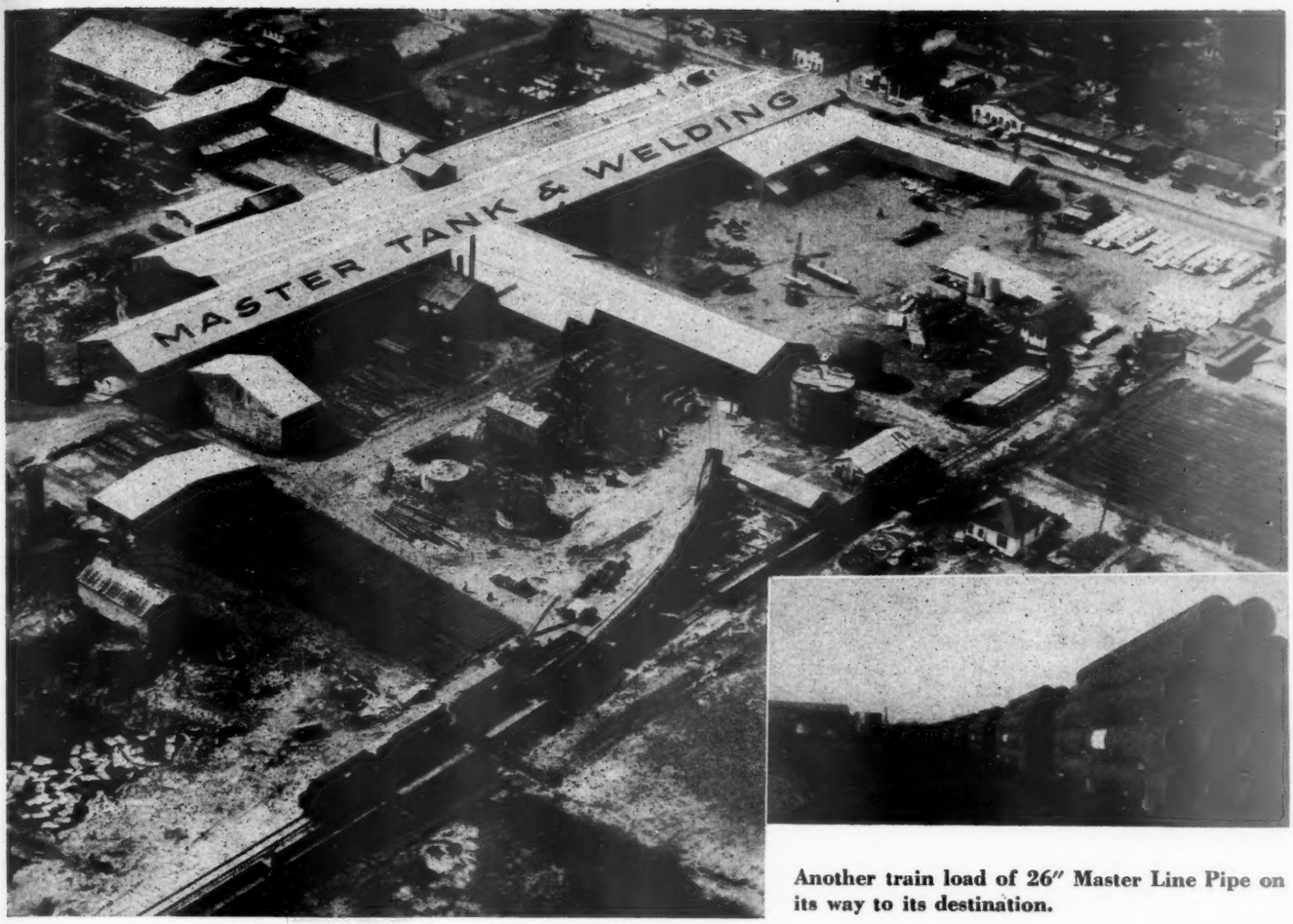


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FIG. 7. Microwave equipment at 42A (Ada). Controls for local operation at left. Open cabinet shows RCA 960-mc microwave equipment.

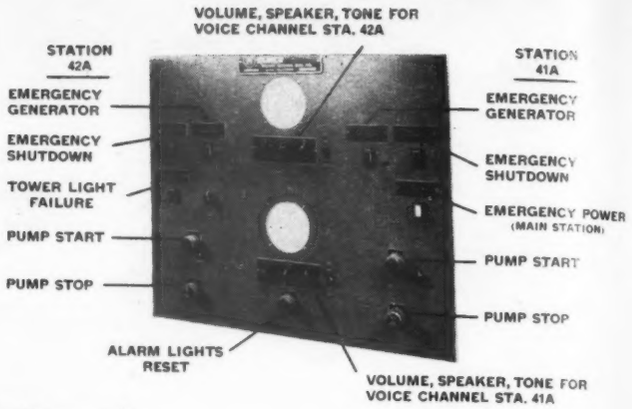


FIG. 9. *Above*, main control panel showing various functions and alarm impulses transmitted by Microwave.

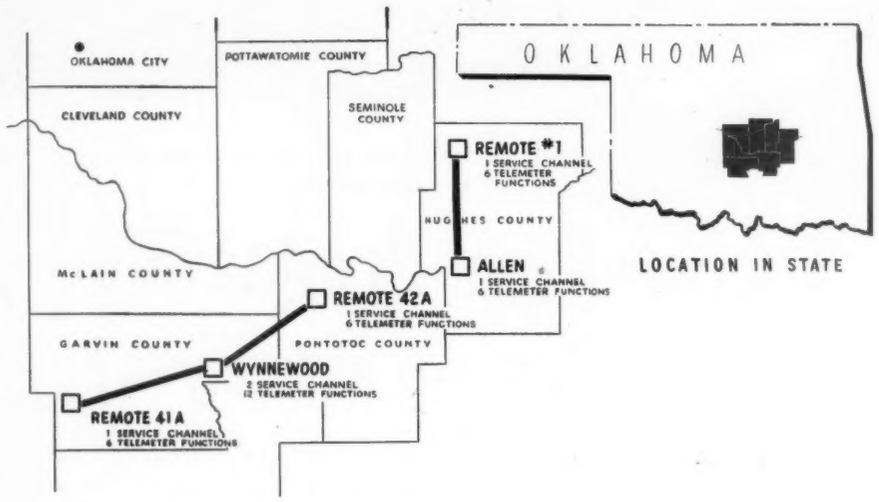


FIG. 10. Map of Sunray microwave system.

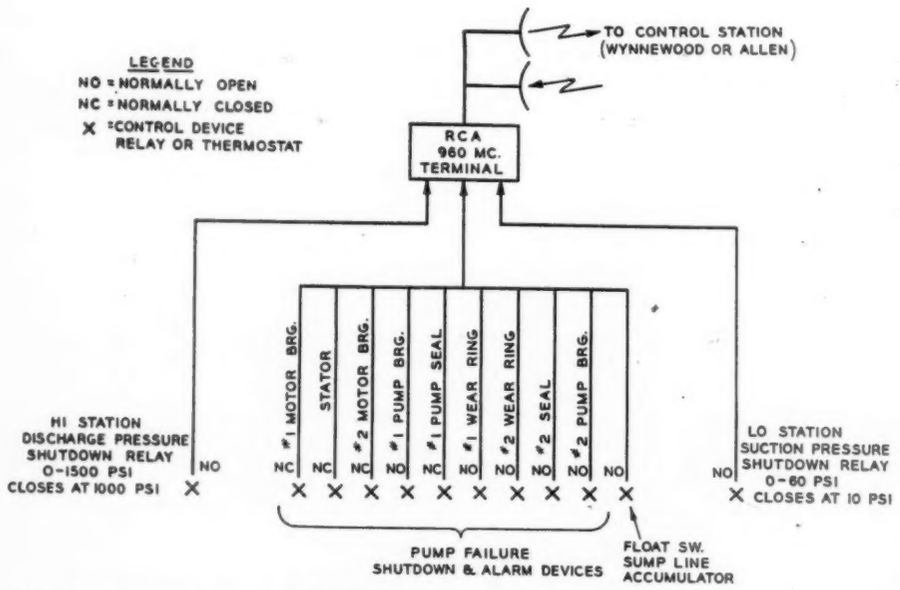

LEGEND
NO = NORMALLY OPEN
NC = NORMALLY CLOSED
X = CONTROL DEVICE RELAY OR THERMOSTAT
TO CONTROL STATION (WYNNEWOOD OR ALLEN)
RCA 960 MC. TERMINAL
HI STATION DISCHARGE PRESSURE SHUTDOWN RELAY 0-1500 PSI CLOSES AT 1000 PSI
#1 MOTOR BRG.
STATOR
#2 MOTOR BRG.
#1 PUMP BRG.
#1 PUMP SEAL
#1 WEAR RING
#2 WEAR RING
#2 SEAL
#2 PUMP BRG.
LO STATION SUCTION PRESSURE SHUTDOWN RELAY 0-60 PSI CLOSES AT 10 PSI
PUMP FAILURE SHUTDOWN & ALARM DEVICES
FLOAT SW. SUMP LINE ACCUMULATOR

FIG. 11. Block diagram of fail-safe features.

quence. Indicator lights inform the operator of shut down. When pressures return to normal, the station may be restarted.

Should power fail at the booster station, the emergency generator starts automatically, and an amber light at the control desk indicates the generator is running. It supplies power for microwave equipment, lighting panel, and valve motors. The station will then go through normal closing sequence.

Provision for Failures

Booster stations automatically remove themselves from the line if any of 10 specific failures occur within the local pumping equipment (see accompanying diagram). In all such cases, a red light goes on at the control desk. To insure foolproof restarting, a manually operated interlock release switch must be closed before the start circuit becomes operative.

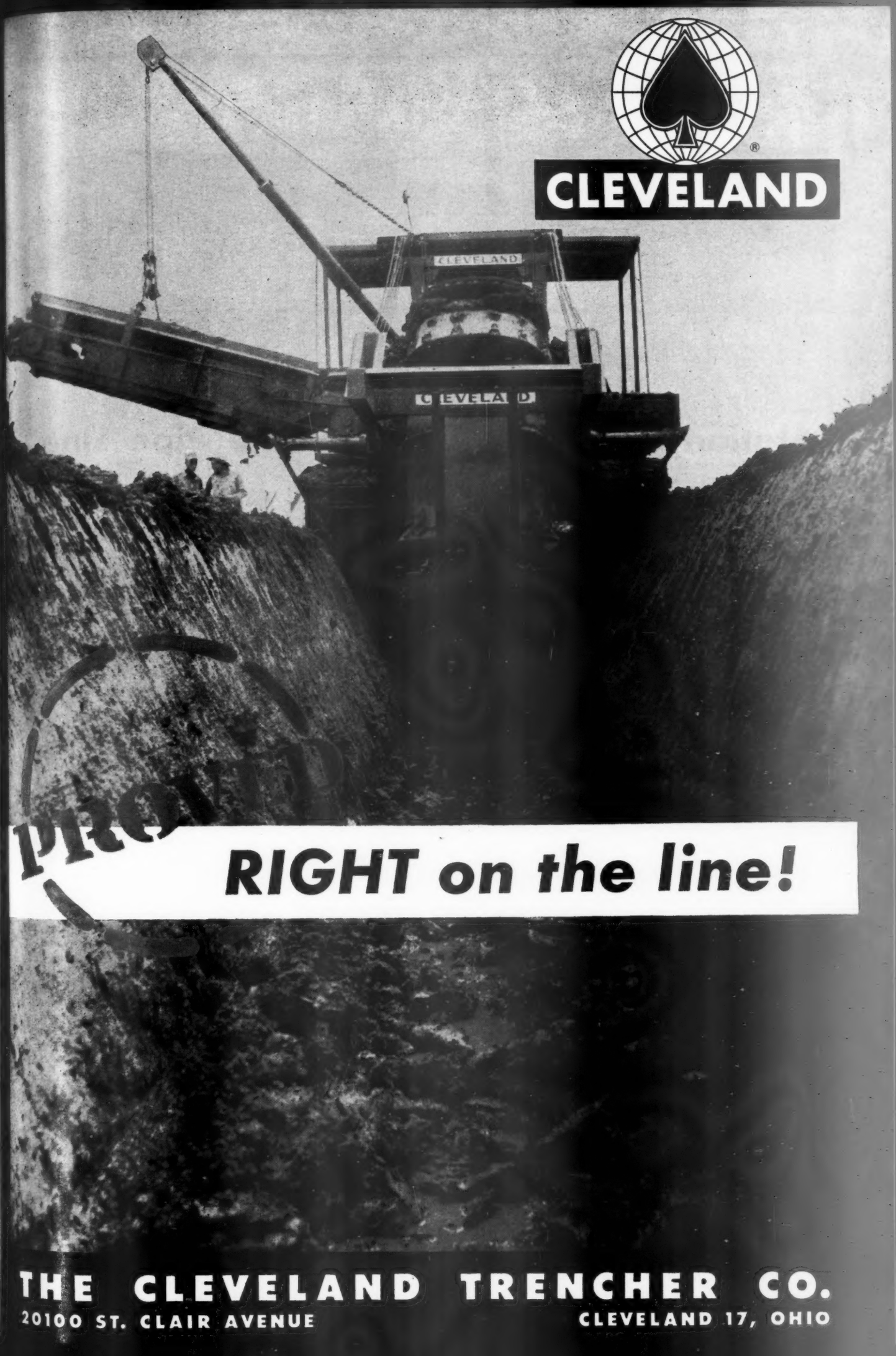
The Civil Aeronautics Authority requires immediate notification in the event of light failure on towers of the heights used at Ada and Wynnewood. A blue light at the Wynnewood control desk indicates tower light failure at Ada. This information is sent from a tower light alarm circuit at Ada via the microwave and telemetering tone equipment to Wynnewood.

Voice Communication

A two-way voice channel has been provided between booster and control stations for use by maintenance personnel. A speaker at control monitors the booster voice channel to alert the operator to an incoming call. A microwave tone signal rings a bell at the booster to alert maintenance personnel to an incoming call. The bell is operated by pressing a button at the control desk.

To provide adequate maintenance, an emergency crew is on call at all times and each booster station is visited at least once in every 24-hr period.

All booster stations were designed and installed by The Refinery Engineering Company of Tulsa, Oklahoma. The Nelson Electric Manufacturing Company of Tulsa constructed control consoles, switching, metering, and alarm equipment. RCA designed and installed microwave and tone equipment. * * *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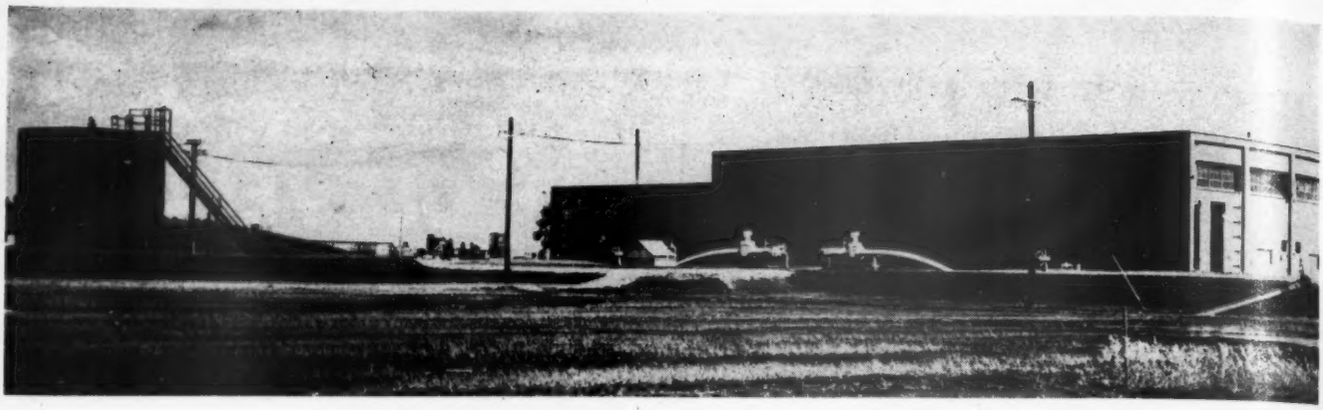


The Gretna, Manitoba, pumping station of the Interprovincial Pipe Line is a typical installation.

Station Design on International Pipe Line

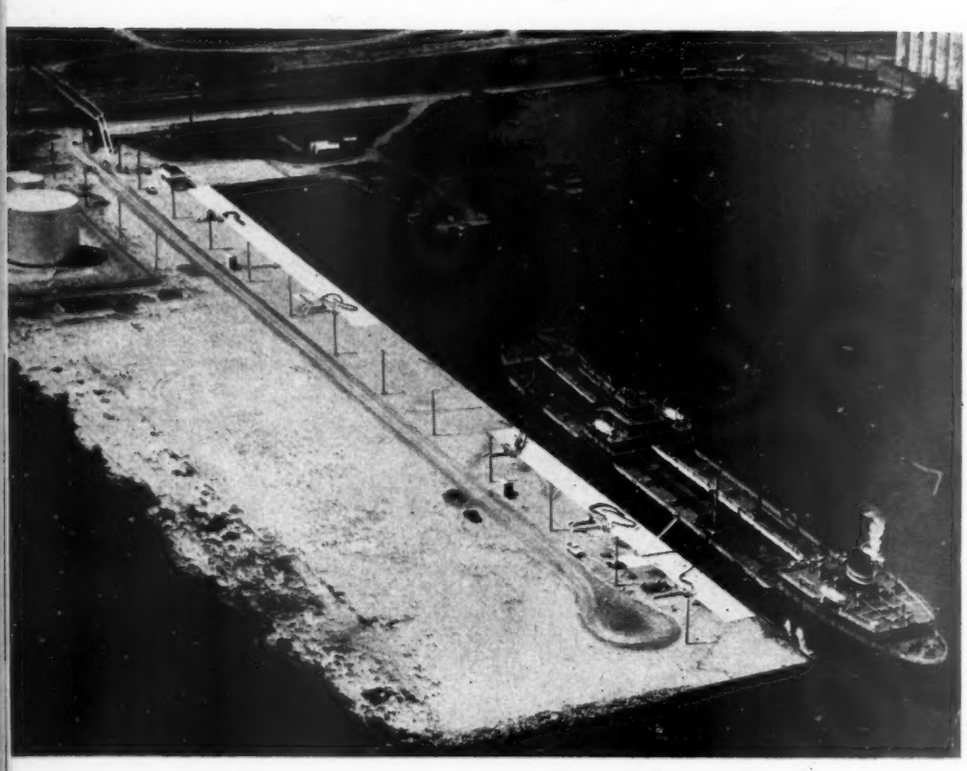
Interprovincial-Lakehead system required treatment of special problems incident to involvement of two countries, Canada and the United States

THE Interprovincial-Lakehead pipe line is the first to carry Alberta oil across the border of Canada and the United States. Planned in early 1949 and put into operation in the winter of 1950-51, this 1137-mile border-spanning pipe line transports crude oil from the prolific Canadian fields of Alberta to the Great Lakes at Superior, Wisconsin. From there it is shipped across the lakes by tanker to Canadian refineries in eastern Ontario.

Not only is the entire system unusual for the international agreements worked out, but the equipment used on both sides of the border is identical. Heart of each station is its diesel pumping engines, which were designed by the American Locomotive Company. These diesel engines were built for stations in the U. S. section of the line at Alco's Auburn, New York, plant, and for the Canadian stations by Dominion Engineering Works of Montreal under a licensing arrangement with Alco.

Outside of a few small gathering lines in the Alberta fields, which were powered by small portable equipment, no major pipe line had ever been built or operated by Canadian personnel nor supplied by a Canadian manufacturer. Before proceeding with construction, Canadian engineers were sent to the United States to observe the experience gathered over the past 50 years of pipelining in the middle west. Two problems presented themselves to these engineers—one was to obtain equipment of Canadian manufacture, and the other was to obtain the experience and "know-how" of American manufacturers who had been suppliers for the pipe line industry in the United States.

This problem of pipe line transportation equipment was similar to the problem of the Canadian railroads. The railroads realized that diesel locomotives were necessary to their operations, but for financial reasons wanted them manu-



An aerial view of loading dock at the terminus of the line in Superior, Wisconsin. The oil is pumped through the pipe line from the Alberta fields to this point, and then trans-shipped across the Great Lakes by tanker to refineries in east Ontario.

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"Varec" FIGURE NO. 2500 AUTOMATIC TANK GAUGE

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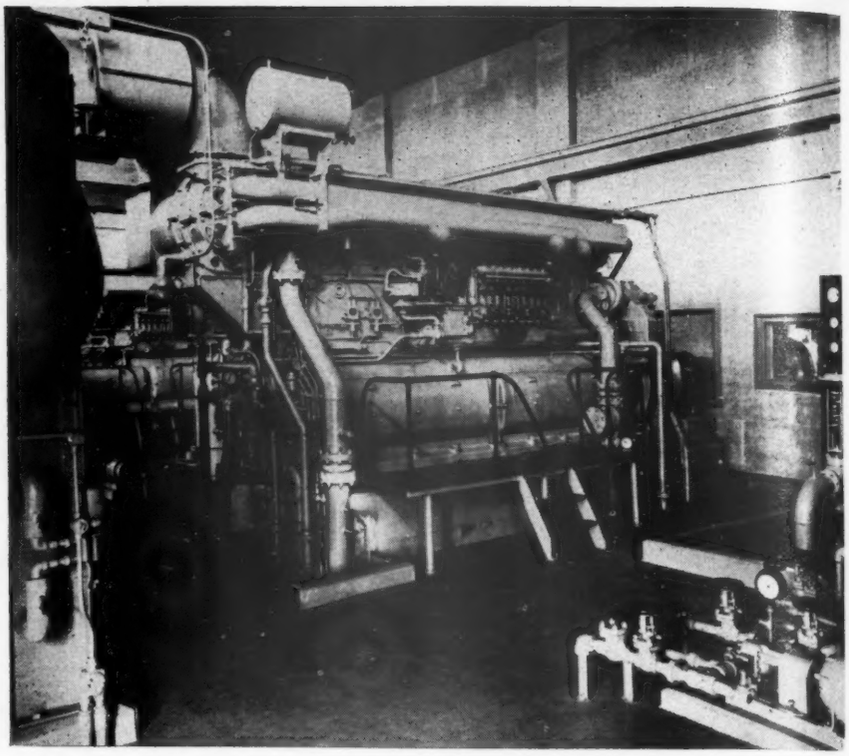
factured in Canada. The company with the most favorable facilities for manufacturing diesel engines of any size in Canada was the Dominion Engineering Works of Montreal. Also at Montreal was the plant of the Montreal Locomotive Works, a Canadian affiliate of the American Locomotive Company. Agreement was entered into between Dominion and Alco to manufacture in Canada diesel locomotive engines of Alco design. These same engines would also be used for stationary operations.

American Locomotive Company has been supplying diesel engines to the pipe line industry since 1915, and has been supplying its standardized 12½ in. by 13 in. engines for stationary use to pipe line companies and other industries since 1938. So the existing manufacturing arrangements for railroad diesel engines fitted very satisfactorily into the overall plans of the oil companies interested in the transportation of crude oil from Alberta to the refining centers of the prairie provinces and Ontario. The oil industry of Canada obtained engines of Canadian manufacture, and by the same token they benefited from the experience of the American Locomotive Company with its "know-how" of pipe line pumping problems.

Another item that governed this international arrangement was the fact that, although there were two separate companies—Interprovincial Pipe Line Company in Canada and Lakehead Pipe Line Company in the United States—the operation of this system would in effect be one, and the personnel would probably be transferred at various times from Canadian stations to stations in the United States, and vice versa. Also, parts for this equipment might be shipped across the international border for use in maintenance or for emergency use. Last, but not least, was the fact that one station design could serve both the Canadian and the United States sides of the line.

The pipe line was originally designed for pumping operations at 200-mile intervals. Initial stations were built in Edmonton in the middle of the Alberta oil and gas fields; Kerrobert and Regina, Saskatchewan; Cromer and Gretna, Manitoba, and a single U. S. station at Clearbrook, Minnesota. Soon after the line was put into operation it was found that capacity increase required 100-mile spacing of stations, making it necessary to construct additional facilities at Hardisty, Alberta; Loreburn and Glenavon, Saskatchewan, and Glenboro, Manitoba. One new station has also been built in the United States at Viking, and another is being built at Deer River, Minnesota. Thus, the line is now served by nine stations in Canada and two in this country, with a third under construction.

Each station is equipped with either two, three or four pumping units connected in series. In Canada these units are either 6 or 8-cylinder, Dominion-Alco 12½ in. by 13 in., dual-fuel or straight diesel engines, whereas the U. S. stations are equipped with Alco built diesels of the same design. All stations are similar, except for size and number of pumping units employed, even down



An interior view of the engine room of the Edmonton, Alberta, pumping station shows 8-cylinder, 12½-in. by 13-in. unit in the foreground.

to the emergency shut-down device for operation from outside the building.

The American Locomotive Company has made as few changes as possible in its standard engine in adapting it for crude oil pipe line service. Its experience in supplying engines for this use has demonstrated that the injection equipment must be of special material.

Also, it had been found that the pistons should preferably be of cast iron, whereas the standard engine, when using refined fuel, is equipped with aluminum pistons. All other items—that is, the bearings, valves, crankshafts, lube oil systems, etc. — are the same as on the many thousands of switching locomotives and the many hundred stationary installations using this same 12½-in. by 13-in. engine.

Due to the fact that these stations are situated in isolated places, and are required to operate at temperatures as low as 50 F below zero and as high as 90 F, the entire station is in one building, protected by fire walls and other devices.

The crude fuel oil is taken from the transportation line and is brought into a settling or rest tank, from which it is pumped to the centrifuges, and from there through filters to the engine day tanks. These centrifuges and storage tanks are set up on a continuous system. The spill from the centrifuges is put back into the pipe line and sent on to the refineries.

The injection system on both the dual fuel and straight diesel engines is typical Bosch with long helix, and oil-cooled Bosch nozzles—all parts made of corrosion-resistant steel.

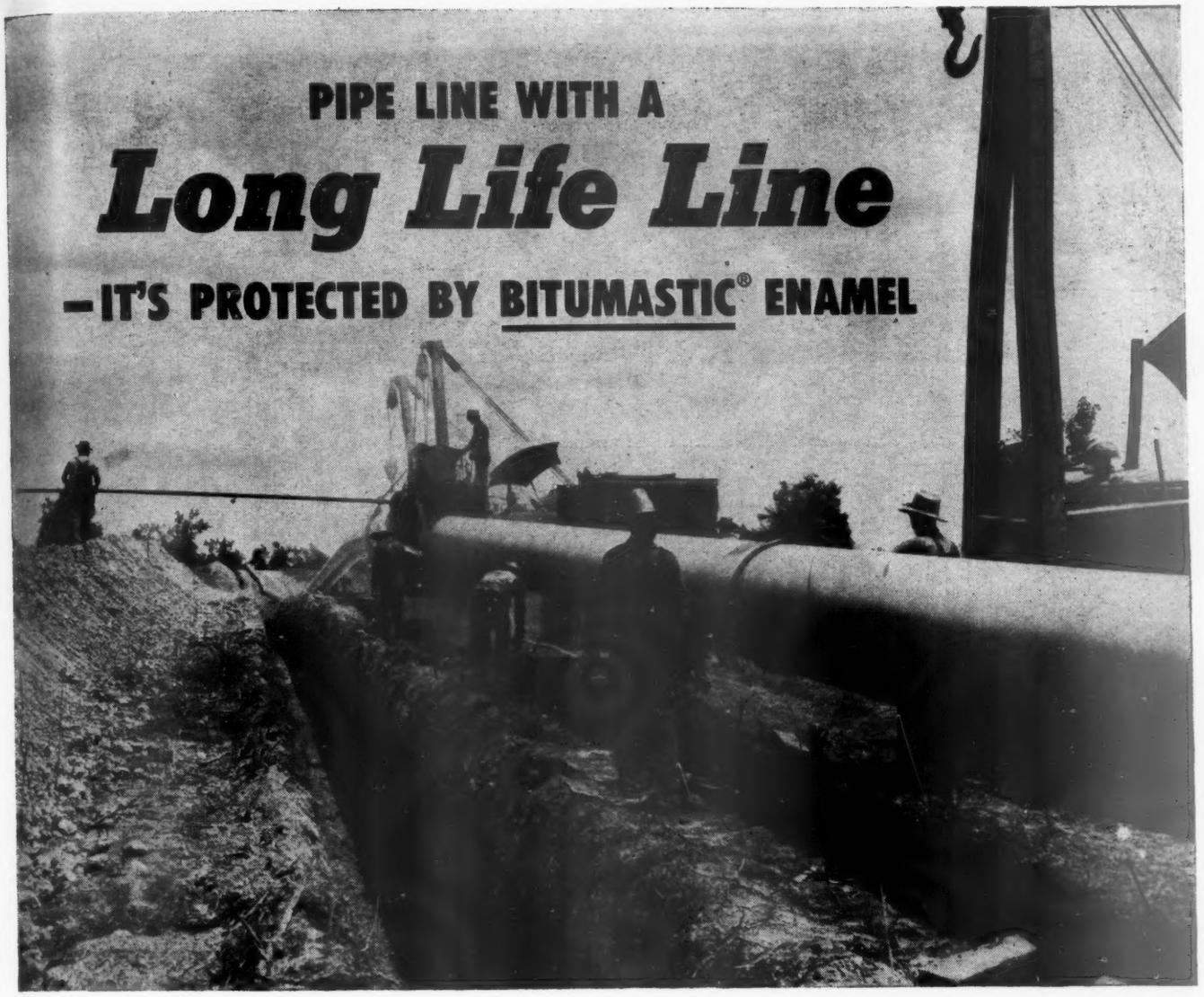
The units drive centrifugal pumps through step-up gears with a ratio of approximately 6:1, the gears in Canada being supplied by Dominion Engineering, and in the United States by Farrel-Birmingham of Buffalo. The main line pumps, which operate in series, were supplied in Canada by the Canadian manufacturing concern licensed to build pumps of Byron-Jackson design, whereas the pumps in the United States were provided by the Bingham Pump Company of Portland, Oregon.

Due to the fact that tankers cannot operate from Superior for about five months out of the year, the stations must operate over a wide range of capacity—as low as 40,000 bbl per day in the winter, and ultimately up to 135,000 bbl in the summer time. All this is done by varying the speed of the engines and cutting engines off at various stations. Some, in fact, are completely shut down.

The Interprovincial-Lakehead pipe line is operated on the closed line system, and its flow is automatically controlled by the pumping rate of the Edmonton station. This requires that all stations and sections of the line pump at the same rate, except where streams are added or withdrawn. To carry out this operation efficiently, each station is automatically regulated to maintain a predetermined suction and discharge pressure.

Closed line operation is a departure from float tank operation, wherein each station and its down stream line operates as a single unit, increasing or decreasing the throughput to maintain a constant stock in the float tank.

Each station is equipped with pneumatic controllers connected to the suction and discharge sides of the line. These controllers are in turn pneumati-



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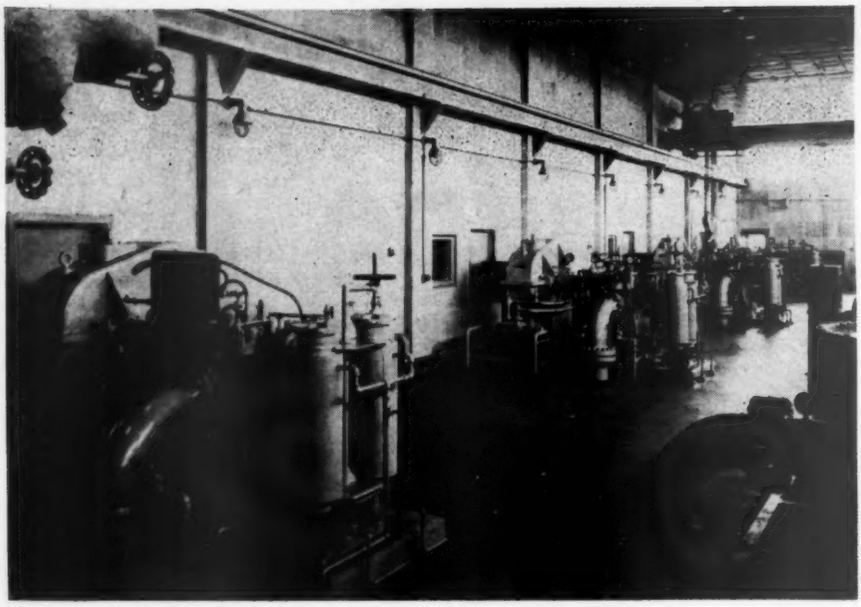

The pump room of the Edmonton station. The pumps are separated from the engine room by a fire wall.

cally connected to individual diaphragm motors located on each governor. If the suction pressure decreases, the suction controller automatically signals the speed controllers. This causes all diaphragms to slow down simultaneously, thus decreasing the pumping rate until proper suction pressure is restored. The discharge controller is set to override the suction controller and is capable of reducing engine speed in the event of excessively high discharge pressure. Woodward-type P. G. governors and Taylor pneumatic controls were selected for this application.

The cooling system, in keeping with modern pipe line practices, incorporated an individual system for each unit. The water circulating pump is built integral with the engine and the heat from the jacket water and the lube oil is dissipated through a shell and the tube heat exchanger to the main oil stream. By suitable temperature controls, part of the water is sub-cooled for use in the lube oil coolers of both the engine and the step-up gear, and then blended back into the engine jacket system, so that the maximum temperature range across the engine is less than 15 F. Both the lube oil and jacket water coolers are of vertical design, which allows the tube bundles to be serviced readily with the aid of the overhead driving crane in both the pump room and the engine room. Strange as it may seem to pipeliners in the United States, the pump room crane is heavier than the one in the engine room, because all manifolding and large gate valves are inside the pump room.

Throughout the design and operation of this international pipe line, the matter of standardization has been uppermost in the minds of operators and designers, and they are particularly fortunate in being able to obtain engines on both sides of an international border that are interchangeable throughout. All pipe line companies are faced with the problem of interchangeability and standardization. It is only by adopting mass-produced equipment that any degree of standardization can be obtained that will guarantee the purchaser many years of low-priced, quickly-obtained renewal parts. * * *

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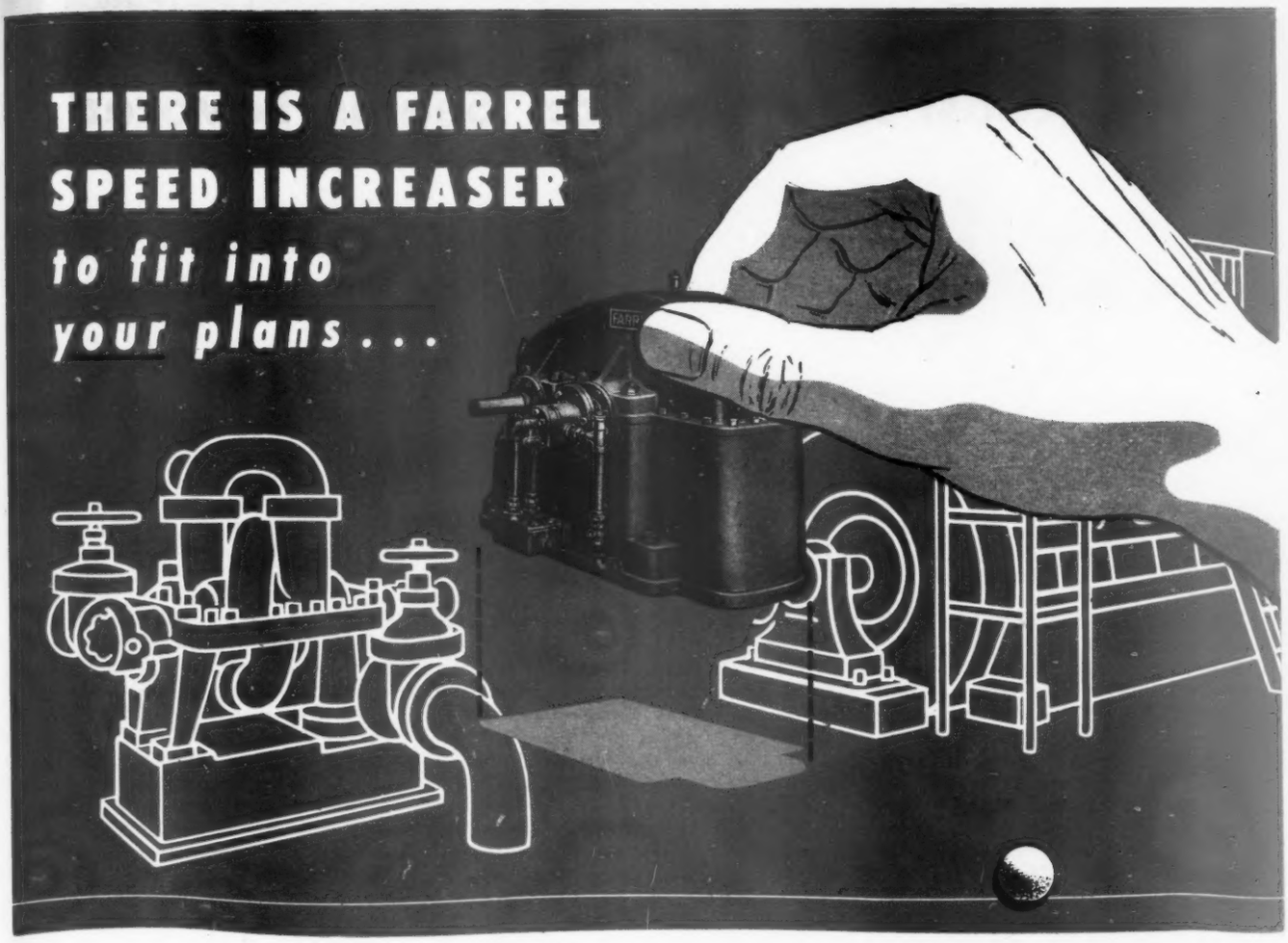

Farrel Type SI units were the first speed increasers to be developed in a standard series for pipeline pumping service. That was twenty years ago, and all of the original units, as well as those installed since, are still in operation.

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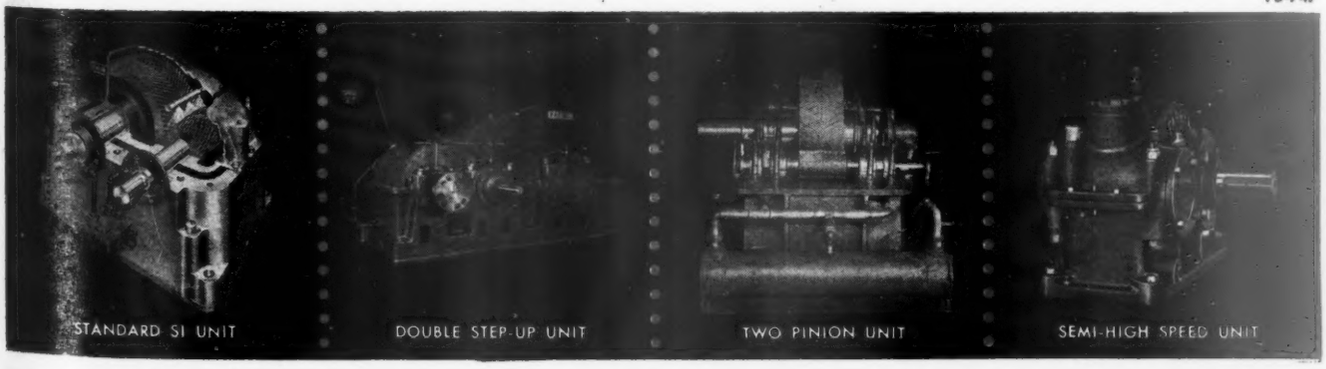

Westcoast's Application Seems Favored

Proposal apparently has best immediate chance to export Alberta gas as Transport Commissioners announce intent to examine reserves

HARRY CHAPIN PLUMMER

WESTCOAST TRANSMISSION COMPANY, LTD., and other prospective exporters of Canadian gas to northwestern United States, have encountered an unprecedented development. At the close of lengthy hearings in Ottawa, the Board of Transport Commissioners for Canada made the surprising announcement that, although recognizing the validity of the Westcoast Transmission Company's argument, the board's own engineering staff and the geological staff made available to it by the Department of Mines and Technical Surveys would proceed to Alberta for an examination on-the-site of the gas reserves in the Peace River district, in order to establish an "independent estimate" of the available existing supply. A conditional decision in favor of the Westcoast application was presaged by the commissioners' statement that "if and when the board decides that the gas reserves are sufficient, leave to construct the pipe line will be granted the applicant."

The statement by the board reads in part:

"In regard to gas reserves the board considers that it has not had sufficient time to appropriately appraise the evidence submitted thereon, and it proposes to procure, by means of its own engineering staff and the geological staff made available to it by the Department of Mines and Technical Surveys (of the Federal Government), an independent estimate of the gas reserves in the Peace River district and such other districts as the board may determine. Without limiting the scope of the above examination it is intended in particular to assist the board in appraising the estimates made by the applicants with respect to reserves recoverable and available for transmission for the line concerning which a permit is sought.

"If and when the board decides that the gas reserves are sufficient, an order will issue granting the applicant leave to construct the pipe line.

"The board is not unmindful that the applicant has stated that an essential part of its project is the exportation of gas to the United States of America and the construction there of certain pipe lines by a subsidiary company of the applicant. The board has also noted the Westcoast Transmission Line application to the Federal Power Commission. It appears by the order specifying procedure at the said hearing that, among other things, the question of supply or reserves is to receive consideration. As the latter question appears to be a matter of common concern to this board and the Federal Power Commission, should the latter desire to carry out an examination in Canada by its own technical staff and advisors of the reserves referred to in the application, this board will be pleased to exchange any relevant information and to offer any facilities which might be of assistance in determining the gas reserves of the applicant.

"With respect to the other applications, the Trans Canada Pipe Line, Ltd., application and Western Pipe Lines application, both applying to export gas eastward from Alberta, the board adjourns their applications *sine die*.

"With respect to the applicants, Alberta Natural Gas Company and Prairie Transmission Lines, Ltd., the Petroleum and Natural Gas Conservation Board of Alberta has refused their applications for a permit to export gas from the Province of Alberta to the Pacific Coast and this board is of the opinion that the aforesaid applications should stand dismissed. In the event, however, that at some subsequent date the applicants should receive permission to export gas from the Province of Alberta they may make new applications to this board. The board has no record of the Champion Pipe Line Corporation, Ltd., ever having filed an application to export gas with the Petroleum and Gas Conservation Board of Alberta. This application will likewise stand dismissed."

Applicants for governmental permission to build pipe lines from the oil and gas areas of Alberta Province to British Columbia, with outlets to northwestern United States have been heartened by recent indications that the American authorities are becoming disposed to favor such development as a defense measure provided the Canadian Board of Transport Commissioners grant the applications.

At the Transport Board's latest hearing at Ottawa upon the application of the Westcoast Transmission Company, Ltd., to build by 1954 a $111,240,000 natural gas pipe line to Vancouver and northwestern United States from the Peace River region of the two provinces, Charles R. Heatherington, representative of a U. S. engineering firm, stated that if the board approves the application that company is confident of grant by the Federal Power Commission for extension of the line into Washington State and Oregon. Hetherington was cross-examined by Bruce Smith of Edmonton, counsel for Prairie Transmission Company, a subsidiary of Pacific Northwest Pipe Line Corporation of Houston, Texas. The latter introduced letters of agreement by six Washington and Oregon gas companies to buy gas from New Mexico if it could be supplied by Pacific Northwest. Hetherington asserted that the Westcoast Transmission Company had like letters of agreement and it was a question as to which company got its pipe line laid first.

EXCLUSIVE

The Bank of Nova Scotia, most conservative of Canada's chartered (national) banks, in its monthly letter, quotes the U. S. Petroleum Administration for Defense as recommending the construction of refining capacity in the northwestern states, now almost wholely served with refined petroleum products from California, and the serving of the area with Alberta crude oil to relieve the anticipated tight supply of oil in the Pacific Coast states, to make the supply of oil in the Northwest more secure in case of war, and to encourage the rapid development of oil reserves in Western Canada, thus enlarging Western Hemisphere sources.

The bank states: "The corollary of this concept of Canadian oil as desirable and indeed necessary for U. S. defense is, of course, the elimination of the 21 cents per barrel, which, although not prohibitive, is certainly a hindrance to southward movement. but how successful the proponents of this view will be in overcoming the opposition to imported crude that exists in the United States remains to be seen."

A footnote qualifies the objection to the 21-cent rate by citing the reduced rate of 10½ cents that applies each year to a quota equal to 5 per cent of the quantity of crude oil processed in United States refineries during the preceding year.

Concerning the question of marketing the vast reserves of natural gas discovered in Alberta, in the course of the search for oil, the bank letter observes:

"Since it became obvious that there

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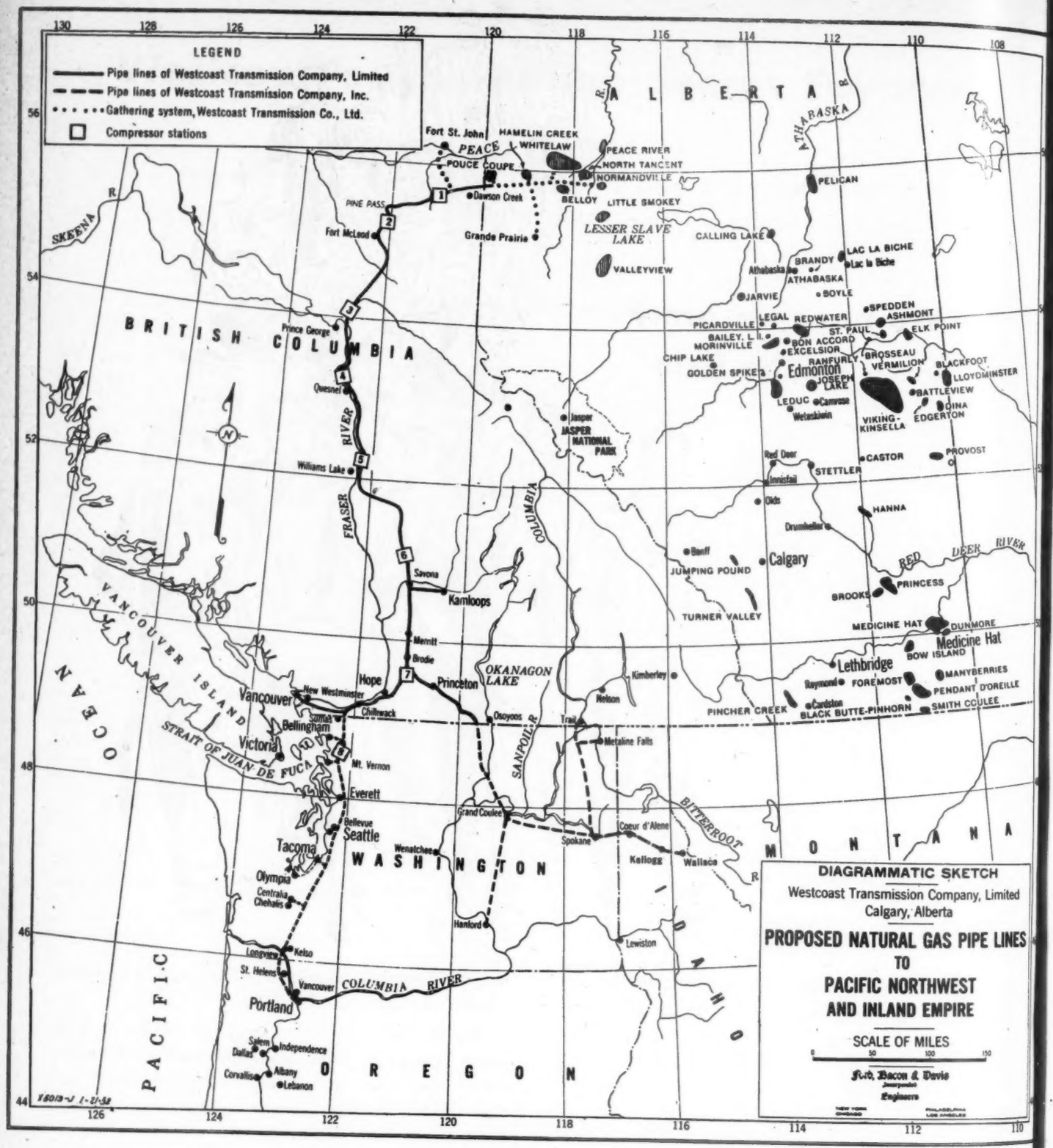

would be a surplus above the needs of the provinces, a number of companies have been incorporated to export gas eastward and westward out of the province. The only actual export so far, however, is the flow through the 17-in. pipe line from the Alberta part of the Peace River country to Dawson Creek, British Columbia, and that from the Pakowki Lake area of southern Alberta to Montana, which was requested by the U. S. Government for the defense production emergency and is limited to 50 billion cubic feet over a 5-year period.

"The stated policy of the Alberta Government has been to allow no large-scale export of gas until reserves were large enough to take care of the present and future needs of the province. After extended hearings, the Alberta Petroleum and Natural Gas Conservation Board, early in 1951, submitted a report stating that established reserves of gas, estimated at some 4700 billion cubic feet, were barely sufficient to provide for the province's requirements for the next 30 years, as estimated by them, and that under those circumstances they could not recommend the granting of any applications for the export of gas. The board did, however, recognize that the export of gas would be in the best interests of the province and of Canada when reserves might be adequate and it accordingly recommended that prompt steps be taken to encourage exploration for gas, as distinct from oil.

"The board has stated that the only gas now considered surplus to the 1952-81 requirements of the province was 300 billion cubic feet in the Peace River area, and it has recommended that all

applications for export be refused except that proposing to draw gas from the Peace River area and pipe it across the Rocky Mountains, via the Pine Pass route, down to Vancouver and across the International Boundary to the Pacific Northwest states. The Alberta Legislature has now endorsed the board's recommendations, including a limitation on total exports for the first five years of 210 billion cubic feet and provisions for supplying communities in the area with gas. * * *

"Reaction to the Alberta Government's decision has been mixed. Companies controlling large undeveloped gas reserves in the southern part of the province naturally are keenly disappointed at the indefinite postponement of the chance to realize returns on their large investment. * * *

"Of course, the present limited permission for export by no means rules out further concessions in the future. It is generally accepted that *potential* gas reserves are far in excess of the Conservation Board's rather conservative estimate of known reserves. Indeed, the board itself has said that, if adequate incentives to explore are given and wildcat drilling continues at a high level, Alberta can safely anticipate the development of further substantial established reserves of natural gas for at least the next 8 to 10 years. The step that has been taken toward large-scale export undoubtedly will give further impetus to the attempt to build up gas reserves by discovery of new wells. And the proving-up of additional reserves may well result in the not too distant future in the approval of further permits for export." * * *

Mid-Valley Building District Warehouses

The Mid-Valley Pipeline Company, Longview, Texas, which operates a 1000-mile Texas-to-Ohio crude oil system, has announced plans for construction of three district warehouses, to be located at Hebron, Kentucky; Oxford, Mississippi, and Haynesville, Louisiana.

These warehouse buildings will be concrete block and wood frame structures with flat roofs and will contain 4800 sq ft of floor space. Each building will contain an office for the district superintendent and the entire back section of each building will be warehouse area. The new warehouses will contain radio facilities.

Contractors began breaking ground for the warehouse at Hebron on May 12. Mick Mikkelson of Florence, Kentucky, is contractor for the construction of the Hebron warehouse.

Construction of the Haynesville warehouse was begun May 19. Elmer D. Thomas of Magnolia, Arkansas, is contractor for the construction of this warehouse.

Contractors for the construction of the Oxford warehouse are B. L. Howell and Sons of Philadelphia, Mississippi. Construction was begun on May 19.

It is anticipated that these new warehouse buildings will be completed by the middle of September.

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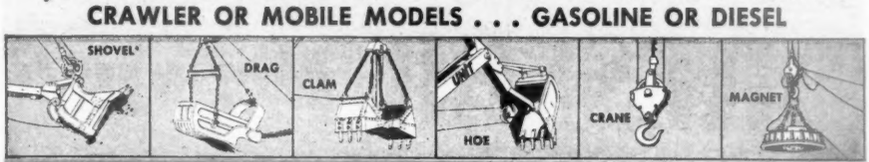

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Natural Gas Treating†

Research and development work expected to result in changes in processes and equipment

T. S. BACON*

THE general subject of "natural gas treating" covers much more territory than there is time to discuss in detail here. Specifically, the entire petrochemical industry is based on chemically treating natural gas or specific fractions of natural gas. Chemical treatment is of general interest to the natural gas technician, but his primary problems are limited to physical treatment of the raw natural gas as it is received from the wellhead. The physical treatments in common use are designed to permit recovery of commercially valuable liquids and gases from the natural gas, or to remove undesirable solids, liquids, and gases from the raw natural gas.

Physical treatments are the bases of the natural gasoline and cycling plants that have been so widely used within the industry almost since its inception. The natural gasoline plant and the cycling plant are identical in general functions and differ only in the general operating pressure levels and in the disposition of the treated gas. The fundamental physical considerations are limited to removal of hydrocarbons having higher vapor pressures from hydrocarbons having lower pressures. The heavy hydrocarbons may be removed by absorption in oil, by selective adsorption on charcoal or similar materials, or by liquefactions at low temperature and high pressure followed by rectification.

Dr. H. L. Huntington, of the University of Oklahoma, published a text in 1950 covering the details of the several processes now in general use for the recovery of valuable liquids from natural gas, and the trade magazines publish many articles each month regarding these plants and processes. Although separation by refrigeration has not been used generally by the industry until recently, this method of physical treatment of natural gas may find very considerable use in the future, as indicated by the Tennessee Gas Transmission Company in Kentucky. This plant has a capacity to produce 380,000 gal of valuable liquid products per day from 750,000,000 cu ft of gas a day.

The oil absorption process is particularly effective for the removal of hydrocarbons heavier than propane. If it is desired to recover substantially all the propane, or if it is desired to remove ethane, the oil absorption process becomes relatively costly, and adsorption or liquifaction plants seem to operate more economically with the present state of the art.

The single present example of commercial treatment of natural gas for the production of a valuable by-product gas is the production of helium from natural gas. As helium production has a limited general application, this process will not be discussed further here.

Hydrogen sulfide and water vapor are the two principal gas-phase contaminants of natural gas that are now removed commercially. There are a variety of processes for the removal of hydrogen sulfide, including the Seaboard soda ash process, the iron oxide box method, and the Girbitol process using an organic amine. The Girbitol process is used extensively by the natural gas industry, is capable of reducing the residual hydrogen sulfide content to a commercially satisfactory figure of 0.25 grains per 100 cu ft, and is fairly economical in many instances. This process, however, requires that the plant be of sufficient capacity to remove all the acid gases including carbon dioxide. Therefore, when natural gases contain relatively nominal concentrations of hydrogen sulfide and large concentrations of carbon dioxide, the natural gas engineer longs for a similar process that would be selective in economically removing hydrogen sulfide.

The mass of precise technical information now available regarding equilibrium constants in hydrocarbon systems permits the accurate engineering design of commercial plants for recovery of heavier hydrocarbons and for the purification of natural gas. This information has been developed and made available through the cooperative efforts of the industry, and the sharing of this information through publication has been constructive to all concerned. There is, of course, much room for further improvement in our store of fundamental information. Significant progress in the accumulation of fundamental information may be anticipated in the future; as evidenced by the interest in the formation of an organization to support research to improve processes and equipment to be used in commercial fractionation by the petroleum industry.

The removal of contaminants existing in the solid or the liquid phase continues to present a significant practical problem to any engineer who needs perfectly clean gas. The commercially available mist extractors and gas cleaners are excellent if contamination of the order of 1.0 lb of liquid per million cu ft of treated gas is permissible. But if 1.0 lb of liquid per million cu ft is excessive and undesirable under the existing circumstances, the engineer must rely on his ingenuity rather than on commercially available equipment. Lone Star Gas Company supplied the City of Dallas with 28 billion cu ft of gas in 1951. If this gas had contained 1.0 lb of entrained mineral seal oil per million cu ft, a total of 28,000 lb of oil, or about 4000 gal would have been released into the distribution system. And 1 gal of oil can have adverse effects in the distribution system. Therefore it is necessary to do a better job in removing entrained oil from the gas supplied to Dallas than can be done with equipment that is commercially available. Lone Star has been able to do a satisfactory job of removing entrained oil from the Dallas gas by installing especially designed drips at strategic points downstream from the oil-bath gas cleaners.

The present mist extractors, of the baffle type or the centrifugal type, are very effective for the removal of dust or liquid particles having diameters in excess of 5 microns but seem to decrease fairly rapidly in efficiency as the size of the contaminating particles decreases below 5 microns. Possibly, a filter type of mist extractor or an electrostatic mist extractor may be developed to remove the last traces of solid or liquid contaminants of extremely small size. The electrostatic precipitator seems to be promising in this regard, to be used as a supplement to the mechanical mist extractor where complete removal of the solid or liquid phase is required. As indicated above, the mechanical mist extractor is particularly effective on the removal of particles of 5 microns or larger. The electrostatic precipitator, on the other hand, increases in effectiveness generally as the particle size is decreased, and is not effective on particles of the size of rain drops; but it will remove particles of fractional micron size, such as pollen. I understand that research work is now under way directed toward the development of an economical and reliable electrostatic mist extractor that may be used on natural gas at the pressures required by our industry. I am sure that many of us would be interested in such a device.

In conclusion, the available engineering data will now permit almost any problem involved in the physical treatment of natural gas to be handled with reasonable economy and efficiency; but we cannot be, and are not now, completely satisfied with the presently available processes. The continuing research and development work will, in all probability, result in significant changes in processes and equipment in the future that will improve the present effectiveness of treating natural gas. * * *

†Presented before Southern Gas Association, Galveston, Texas, April 28-30, 1952.

*Chief engineer, Lone Star Gas Company.

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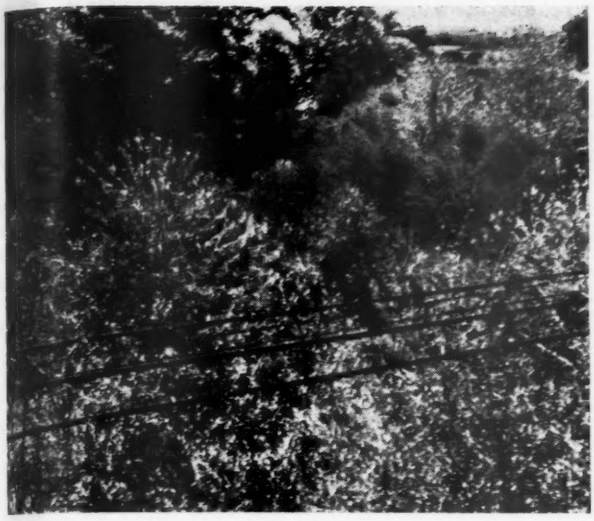

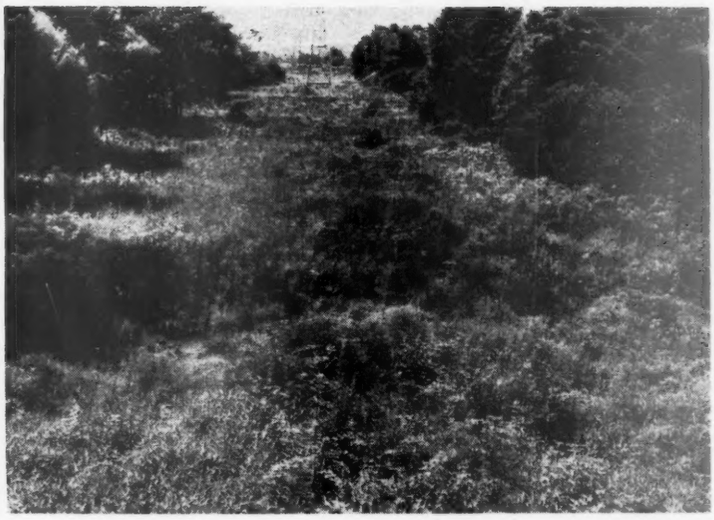

Scene at left illustrates the condition of a flat-land right-of-way underneath a power line in August 1947, a few days after a foliage spray was applied to the woody plant growth. This right-of-way had gotten out of control during the war years, and brush was 15 to 20 ft high. About a year after spray was applied, dead stems were cut, and view at right (taken from a slightly different elevation) shows condition of this right-of-way in mid-summer, 1951, four years after spray was applied. While right-of-way contains a complete cover of the herbaceous growth, there was at that time only an occasional leafing woody plant.

Chemical Brush and Weed Control*

Development of chemicals for the purpose has reduced costs when compared with hand or mechanical methods

HOMER L. JACOBS†

DURING the last 25 years cross country and roadside rights-of-way for utilities have multiplied many times. Most rights-of-way except where they pass through cultivated land require some sort of vegetation control to best serve the interest of the utility, whether it be a telephone or power line, pipe line, railroad, or public highway. Many such lines traverse swamps, hills, mountains, or rocky areas relatively inaccessible to mechanical equipment such as power mowers or saws. Even where conditions permit their use, bulldozers, disk or roller cutters, or other earth-disturbing machines may not serve the purpose because of expense, need for frequent repeat operations, or possibility of causing erosion. Consequently, until recent years hand labor has been the mainstay in fighting unwanted vegetation, especially woody species, which make the most troublesome and costly growth on most rights-of-way. In this machine age, with an ever-decreasing supply of common labor, fighting brush and other vegetation by hand becomes an increasingly expensive, burdensome, and almost hopeless task for many maintenance superintendents.

Fortunately chemical developments of the last seven or eight years have resulted in established techniques by means of which many companies are rapidly reducing brush control and, to a lesser extent, weed control to a less expensive and less frequent operation than it has been under hand or mechanical operations. Furthermore, under chemical treatment, the average right-of-way the year round becomes a more accessible and more usable area for patrol and maintenance than ever before.

These new chemicals and methods are the result of research and pioneering by the chemical companies, service contractors, and utilities, particularly power and telephone companies. So pressing has been the brush problem for power and telephone systems that many of them are now in their sixth or seventh year of well-established brush spray programs.

It has been my pleasure since the close of World War II to have had a part in the research and development of chemical brush and weed control service for the Davey Tree Expert Company in the eastern two-thirds of the United States. This service is being used by power and telephone systems, highway departments, railroads, mill and factory groundskeepers and, to a lesser extent, in solving pipe line and tank farm problems.

These problems vary depending on type of vegetation present, growing conditions, degree of control desired, budgetary limitations, and other factors. No one chemical or method meets all requirements or solves any one problem permanently. As a given plant reacts to a given chemical the same whether it be over a pipe line, under a telephone wire, or along a railroad track, I shall discuss briefly the chemicals and methods without specific reference to your problems with which you are more familiar than I am.

Woody plants can be controlled, or, if desired, almost completely eradicated by one or more of three chemicals in common use. The first of these, the familiar 2,4-D, readily kills a few species such as willows, sumac, elderberry, and perhaps others. However, 2,4-D is effective on such a limited number of species that its use alone is disappointing on mixed species. The closely re-

*Presented before Petroleum Industry Electrical Association, Tulsa, Oklahoma, April 14-17, 1952.

†Technical Service Director, The Davey Tree Expert Company, Kent, Ohio.

lated chemical, 2,4,5-T is effective on a much wider ranger of species. For example, it is almost a specific for Osage orange or hedge, blackberries, and mesquite against which 2,4-D is of little use. It is also somewhat injurious to oaks, ashes, hawthorns, and some of the maples. 2,4,5-T thus greatly extends the usefulness of these hormone-like chemicals.

As most right-of-way brush consists of mixed species most chemical brush control is carried on with commercial formulations containing equal parts of 2,4-D and 2,4,5-T. These formulations should contain not less than 4 lb of combined 2,4-D and 2,4,5-T per gallon of concentrate. They are on the market under various trade names as "Brush Killers". These Brush Killers applied as foliage sprays are quite effective in controlling or killing sassafras, elms, willows, elderberry, sumac, wild cherry, Osage orange, mesquite, sage brush, boxelder, and perhaps other species. They are not so effective against persimmon, hackberry, hawthorn, most of the oaks, ashes, maples, and hickories although many of these species can be controlled or eventually killed out by thorough and repeated sprays of the 2,4-D - 2,4,5-T Brush Killers.

The third chemical used in fighting woody growth is ammonium sulfamate, found on the market as DuPont's "Ammate". Ammate is generally a much more effective killer of woody species than the mixtures of 2,4-D and 2,4,5-T. While as effective as the Brush Killers on elm, willow, wild cherry, and black locust, one foliage application of Ammate will give much better kill of oaks, maples, ashes, and hickories. It is less effective than the hormone-like Brush Killers on Osage orange and like them is not too effective on hackberry or mulberry.

When we directly compare Ammate and the Brush Killers we find each has some advantages and disadvantages. Initial foliage applications of 2,4-D and 2,4,5-T are somewhat cheaper than Ammate foliage applications; being a more effective killer, however, Ammate is perhaps no more expensive over a number of years as it doesn't have to be used so often. Where willow or other easily killed species predominate 2,4-D - 2,4,5-T mixtures may be chosen, but where oaks, hickories, ashes, and maples are dominant there is no point in spraying repeatedly with Brush Killers to obtain control when one Ammate application will do it. In relatively inaccessible locations where cost of application is high the chemical or method giving the greatest kill may be cheapest in the long run.

For foliage sprays the Brush Killers are usually diluted in water at the rate of 1 gal of the concentrate to make 100 gal of solution. Ammate is used at the rate of 75 to 100 lb to 100 gal of water. Both solutions are used in sufficient quantities to wet all leaves and green twigs on the brush.

Except in the wildest of locations, possible effect of any chemical on surrounding vegetation must be considered because of its bearing on public relations. Any material that kills woody plant species may kill crops or ornamentals alongside the right-of-way if carelessly used. 2,4-D and 2,4,5-T are hormone-like in their effect and have caused damage of disastrous proportions when used by ignorant, unskilled, or indifferent workmen. Such damage to sensitive crops may be caused by particles of spray drift, or by vapors given off by the formulations commonly used, for some time after they are applied. Cotton is the classic example of a crop that is extremely sensitive to 2,4-D in even minute quantities. Most of you no doubt are familiar with the bad public reaction to the use of 2,4-D in the vicinity of cotton in Texas and elsewhere. Although we think of cotton first in this connection, the same possibility for grief exists in the use of Brush Killers near many other crops such as tomatoes, watermelons, beans, tobacco, grapes, cabbage, and alfalfa. Ammate does not vaporize, does not have hormone-like effect and, by controlling direct spray drift, can be used with safety directly alongside any crop. Where crops sensitive to 2,4-D and 2,4,5-T are common, the use of the safer and more effective Ammate is always indicated even though the initial cost may be slightly greater.

The cheapest and most practical method of initial attack on a right-of-way choked with dense brush, briers, and vines is by means of the foliage sprays just described. Basal or stem sprays of

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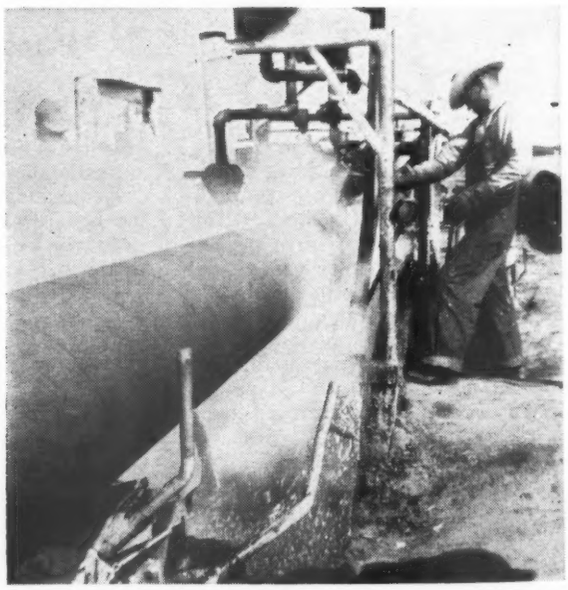

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the Brush Killers diluted in oil are sometimes used. These are more expensive to apply than the foliage sprays except on scattered brush. They are most practical for spot treatment of occasional clumps or where most of the woody stems have been eradicated by previous foliage sprays.

These basal sprays are usually applied during the dormant season when leaves and weeds offer less interference to application. During the dormant season there is less danger of off-the-right-of-way damage to crops from either drift or vapor. Basal applications are usually made by use of knapsack sprayers, using 4 gal of Brush Killer concentrate in 96 gal of fuel oil. Thorough application of this solution all around the basal 18-24 in. of each stem is essential for good kill of most species. Ammate is not recommended for stem treatment.

Fair to good kill of roots of many woody species can be obtained by thorough drenching of freshly cut stumps with the above mixture of Brush Killer in oil or with a solution made of 4 to 6 lb of Ammate in enough water to make a gallon of solution. Stump treatment is most practical following original right-of-way cutting to prevent, as completely as possible, ever letting the area grow up to brush.

What does it cost to spray brush? The answer depends on many variables such as height, density, kind, and accessibility of the woody growth to be killed. Perhaps the most convincing evidence that it is cheaper and better than cutting is the fact that chemical control for a number of years has been rapidly replacing hand cutting in many power, telephone, and railroad systems. The best example of this in Texas, Oklahoma, and Kansas can be found in chemical control work of the AT and T and the Southwestern Bell Telephone companies. In the north and east I might refer you to the programs of the Niagara Mohawk Power Company of New York, the Consumers Power Company in Michigan, The Duquesne Power and Light Company of Pittsburgh, and the Pennsylvania Railroad in Ohio, Pennsylvania, and New York.

In addition to the woody species most maintenance men have areas in which chemicals could probably help control grasses and coarse broad-leaved weeds. For tank farm or refinery areas where grasses are desirable but where you want to control occasional clumps of brush and rank broad-leaved weeds, foliage spraying with Brush Killers is quite effective as it suppresses most broad-leaved species with no harm to grasses. Where grass growth is also so rank as to present a fire hazard add 100 lb of sodium trichloroacetate to 100 gal of the diluted Brush Killer solution. Such a spray should give the desired result on brush and broad-leaved weeds and suppress grasses without sterilizing the soil enough to encourage wind or water erosion.

One may want almost complete freedom from vegetation in the moat around oil tanks, in transformer or pole yards, in repeater station grounds, around mile markers, wood pole structures, or other areas. It is suggested that interested persons get acquainted with what C. M. U. weed killer will do to solve the individual problem. It is a DuPont product, new on the market but a real comer in the weed killer field. It is a soil sterilization type of chemical and is only sightly soluble in water. Unlike arsenic compounds it is not poisonous to animal life and unlike the chlorates is not corrosive or a fire hazard by nature.

Although at present higher price per pound than most weed killers, CMU is used in relatively small dosages and so is comparable in unit cost per acre with, for example, the commonly used borates. No doubt kill will be found to vary under different conditions. We have experimental areas now going into the second year entirely free of vegetation following applications of CMU—25 to 50 lb of CMU 13 months ago. These plots contained mixed weeds and grasses in an area of 40 in. of annual rainfall. Some of the earliest applications of CMU anywhere were on Johnson grass in Louisiana where 50 or more pounds have kept the surface free of this troublesome pest for nearly two years.

Do not use CMU as a selective killer. It is most effective on grasses and should not be used except where complete soil sterilization is desired. For best results we believe it is most effective applied as early in the growing season as possible.

* * *

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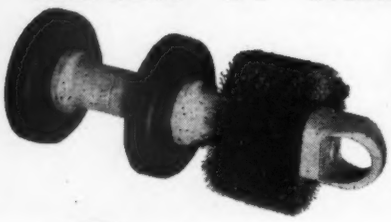

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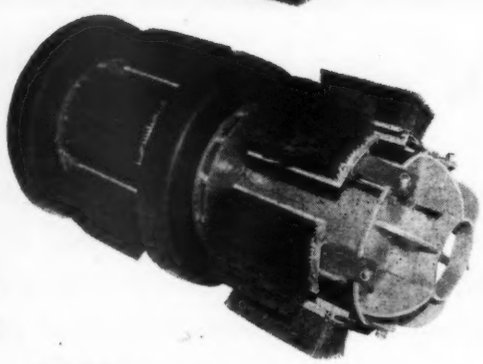

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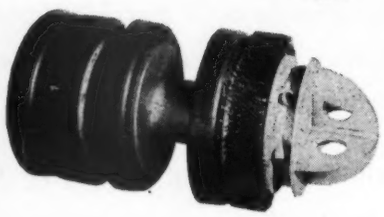

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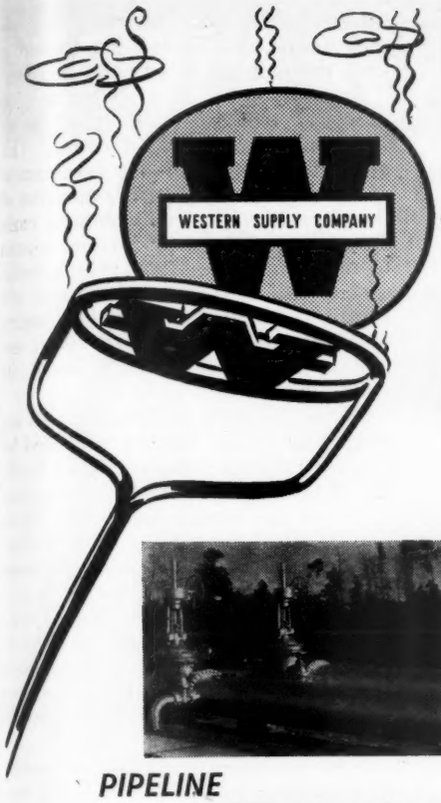

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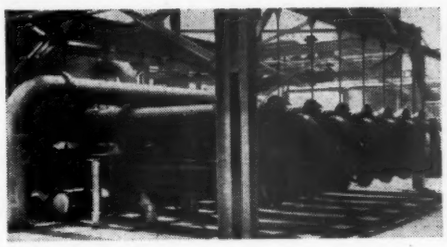

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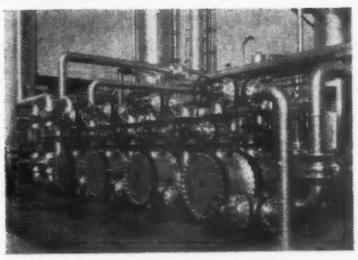

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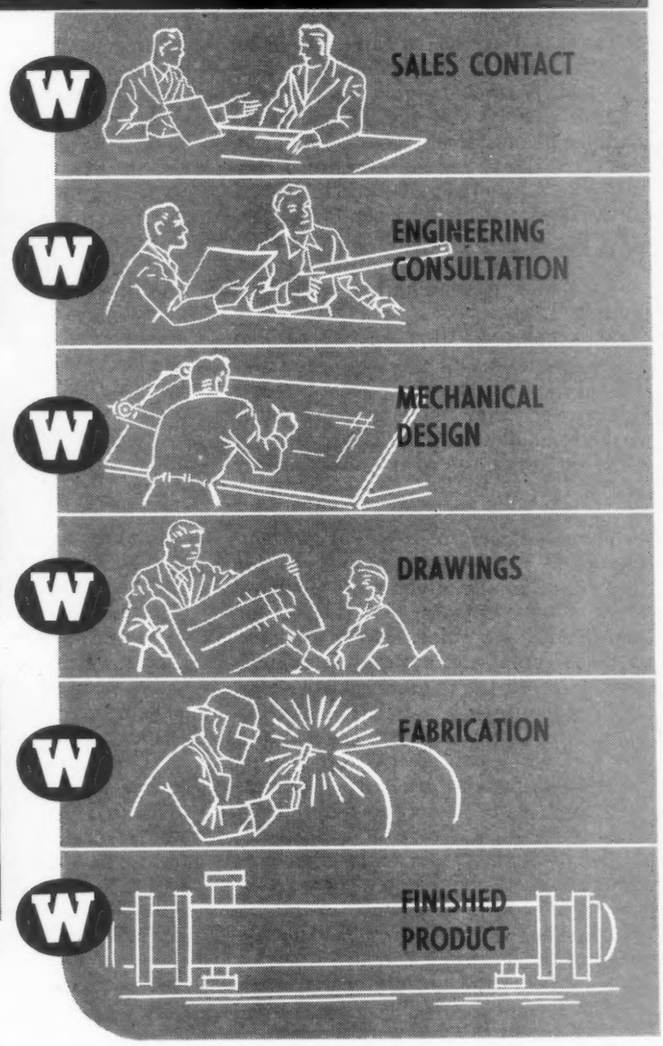

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SAFETY EDUCATION†

It is good business to develop responsive employee cooperation by giving greater attention to individual

J. H. McKENZIE*

GENERAL PETROLEUM came into being in 1912 through the laying of a pipe line from the San Joaquin Valley to the Harbor area. At that time, the men wore handlebar mustaches, chewed tobacco, drank whiskey, and were really a rugged bunch of individuals. Practically all of the work was done by hand—the digging of ditches, laying of pipe, threading, etc. The areas were without roads, and much of the hauling had to be done by horses.

The laying of this pipe presented many problems as it was one of the first jobs of its kind. The line passed through desert and over miles of extremely rugged mountains that were virtually impassable because of the heavy underbrush. Due to lack of experience, most of the problems encountered were solved by snap judgment of the individuals in the field. The service for which this line was originally intended was to bring crude oil to Los Angeles Harbor for fuel for seagoing ships. Shortly after the line was completed, however, a refinery was built and the natural growth of an oil company took place — gasoline plants, marketing department, etc., and last but not least, effective procedures for accounting of the oil and finances.

As time went on, technical problems came along such as corrosion, electrolysis, erosion, which had to be solved in order to effectively operate. These problems along with thousands of others were gradually worked out by people working for our company and working with other people in the same field through such organizations as the American Petroleum Institute.

Many lessons were learned the hard way. For instance, in April 1924, the company decided that it would do some welding at one of the pipe line stations. This was the first time it had ever attempted such an activity and it resulted in burning down four 55,000-bbl tanks and part of the pipe line station. This brought about a very strict policy and a company rule that welding should never be done within the confines of any of its properties. This, like many other regulations and rules made at the time of a disaster, only tended to slow down improvement of the methods of repair and construction and, needless to say, was ultimately changed.

As pointed out, through the technological advancement brought about by people like those working in our company and through such organizations as the API, procedures were developed and instituted in this industry that permit us to do these things safely. Physical safeguards were created and installed to help carry out maintenance programs and new construction work. We developed very elaborate plans or procedures for carefully keeping tab on money, products, buildings, and equipment. It is true, we have set up large numbers of people in research to insure the continued existence of our company through the finding of new oil reserves, obtaining maximum yield from the old and, to keep up with competition, continually trying to perfect new and better products, and new procedures.

These and many other activities have gone towards making up this company, and to keep all of this going, more than 6000 people handle this activity in 11 western states.

At this moment let's hestitate. It has been repeatedly heard in the last few years that the people are the most important part of a company. As pointed out, we have established procedures that deal with material assets, but what have we done with this important segment of our company—these 6000 plus employees?

To go back to the beginning, in the early days, the employees were a hardy lot who moved about working here awhile and then going on. As the oil business became stabilized, the industry realized that it was good business to keep people as permanent employees. This they wanted to do for obviously selfish reasons, one being that an employee who stayed with you was usually a more stable individual and thus a more consistent and better worker; another, and a really important one, it costs a lot of money to hire and break in new employees. In order to hold the employee and keep him from moving about, benefit plans were inaugurated that through the years of their employment became greater in value as a security to the employee. Some of these are annuities and insurance plans, vacation plans, medical benefit plans, savings plans, etc. These have tended to keep the employees with the company.

By now you are all probably wondering what this has to do with the assigned subject, "Safety Education." This gives you a picture of the development of an oil company. The organization of the physical part of the company came first, followed by those functions related to the employees. All of this is evolutionary and slow. It has been and will be affected by the actions and thoughts of all the people who have been employed by your company since its inception.

Radical changes in operations do not happen overnight, but are tempered by already existing equipment and facilities. Whenever a new and efficient pump is put on the market, we do not try to replace all of those being used. Neither do we, each time an apparently wonderful idea on industrial relations is presented, completely revise our industrial relations policy. What we must do is evaluate change, and when it is determined that change can do us a better job, we gradually fit it into our overall structure.

A brief outline follows of one industrial relations project that is being carried out in General Petroleum. It is not a new idea, but recognizing the principles as previously stated, we have through experimentation and study made it adaptable to our company. The project is an employee development guide we call "Paths of Progress." It is an organized method for periodically evaluating the performance of people on their jobs. It is designed to prevent snap judgment, petty politics, or emotional bias from influencing performance evaluation. It makes certain that the individual is informed on the question, "How Am I Doing?" The important by-product of the plan has been that it shows the individual his weaknesses and, through counseling, how he can correct and improve them.

Collectively studied, these evaluations give the department a knowledge of the overall weaknesses of its employees and can be used as a guide to the type of education that should be given to groups or the organization as a whole. In a deal of this kind there has to be sincerity, and no trickery. It has to be sold on the basis that brings real benefits to the individual.

As you will note, the word "safety" has been mentioned only a couple of times in this article. This has been done deliberately because to the author, safety is only a part of a job and a good sound attitude. This question, "How Am I Doing?" with sincere counseling from supervisors, seems to be the key to safety and all of our other industrial relations problems.

The basic philosophy behind "Paths of Progress" is: General Petroleum management believes that business is more than a place or a plant for the production and distribution of goods. It also recognizes that business activity is

†Presented before Products Pipe Line Conference, Division of Transportation, American Petroleum Institute, Fort Worth, Texas, April 21-23,1952.

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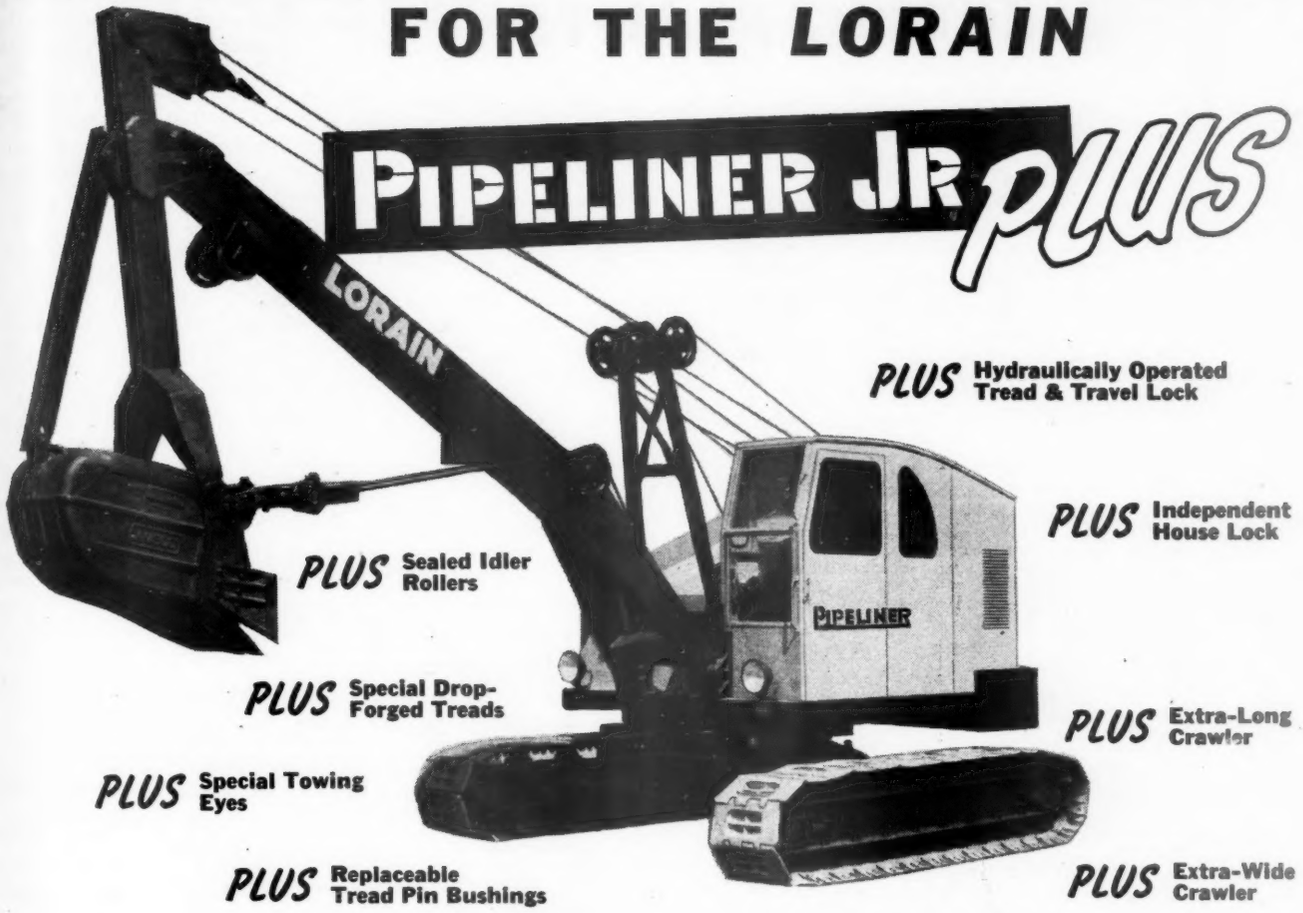

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essentially a series of human relationships. These relationships must be healthy if there is to be any worthwhile, long-lasting, smooth-running business operation.

Healthy relationships grow out of the practice of basic human relations principles that stem from a sincere belief in the dignity of each individual and a desire to bring benefits to people. We all want certain things to some degree in the process of earning our livelihood simply because they represent basic human drives or wants. Probably the most fundamental of these desires are:

(1) To have a sense of security. By this we don't mean any pampering from cradle to the grave in an economic sense. In our jobs we want the *emotional* security that comes from having definite knowledge at all times as to how we are doing and how we stand with our boss and with the company. It is this kind of security, too, that releases our fullest energy and helps us do a better job.

(2) To be recognized and treated as an individual human being. We want to feel that we and our job are important. We don't want to be merely a number on the payroll or a cog in the machine.

(3) To progress in the company. Either we desire a better job in our present line of work or we may want to be placed in another line of work for which we have more aptitude, where we would get greater job satisfaction, and in which we would have more chances to progress.

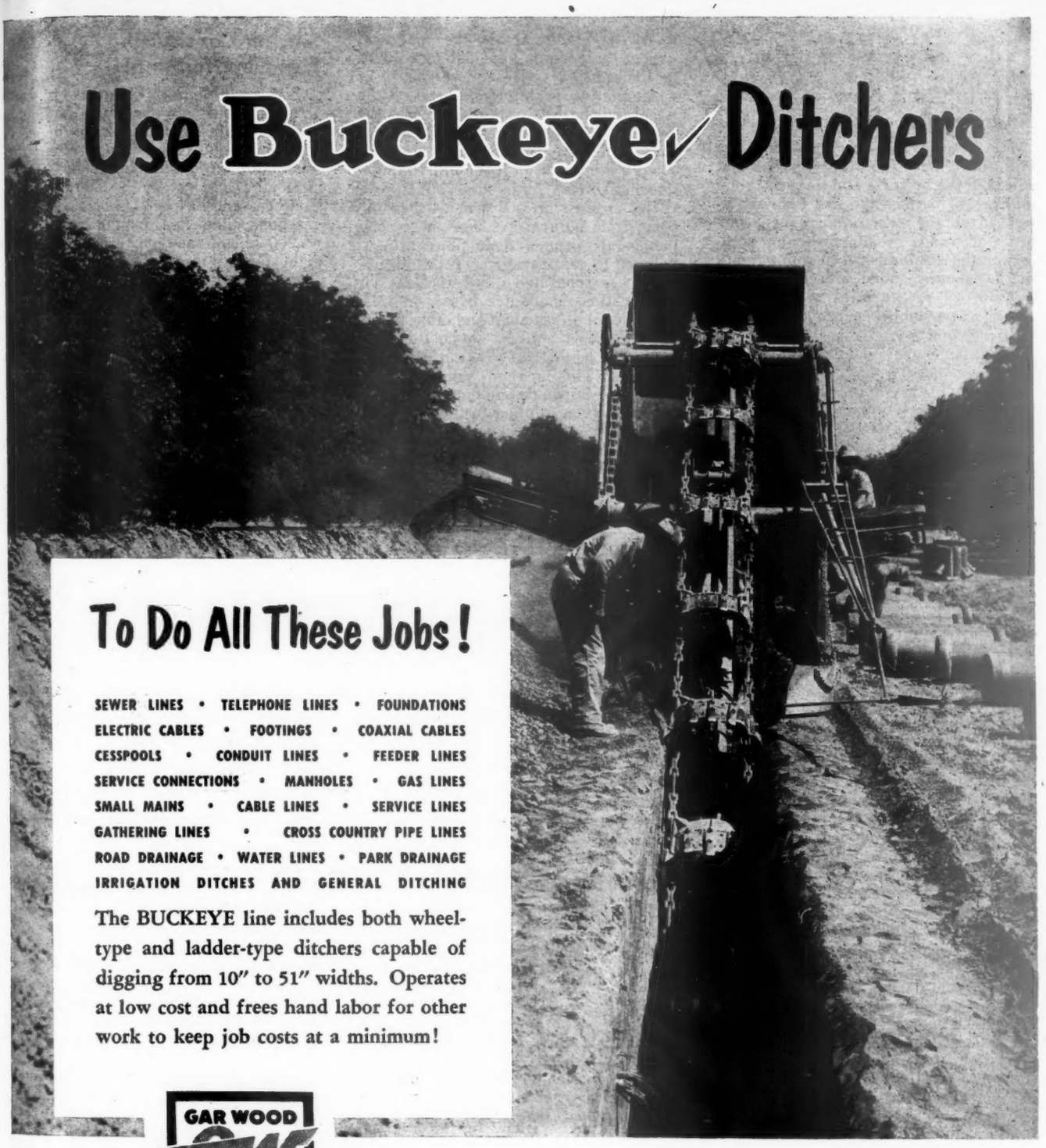
(4) To get fair and honest treatment.

Supervisors sometimes lose sight of some of these fundamentals. We sometimes become so enmeshed with *things* that we neglect *people*. One good reason for this is that we have never had an organized program to guide our efforts and serve as a constant reminder of the human element. It is sincerely believed that "Paths of Progress" is a tool that will make it possible to do a much more effective job along this line.

The company has a selfish motive, too, because "Paths of Progress" makes sense from a strictly economic viewpoint. It is simply good business to develop responsive employee cooperation by giving greater attention to the individual—by encouraging maximum development of his capacity—by increasing his opportunities for achievement—and by satisfying his quest for significance. One of the country's leading businessmen recently said it this way:

"If money, materials and equipment are available to all my competitors on equal terms, then the greatest potential source of advantage that I have is a more effective utilization of my human resources. Thus, it's just good business to encourage maximum development of individual capacity in your organization. It gives you a competitive advantage. It shows on the profit sheet." ★ ★ ★

Use Buckeye Ditchers



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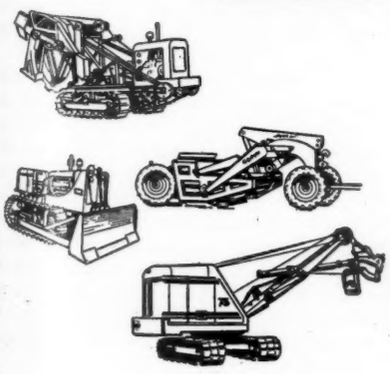
IRRIGATION DITCHES AND GENERAL DITCHING

The BUCKEYE line includes both wheel-type and ladder-type ditchers capable of digging from 10" to 51" widths. Operates at low cost and frees hand labor for other work to keep job costs at a minimum!

No. 529

GAR WOOD GW INDUSTRIES



Gar Wood construction equipment includes 12 new TipDozers and Dozecasters, both hydraulic and cable controlled, for use with all models of Allis-Chalmers tractors . . . Big, tractor-drawn scrapers work smoothly and efficiently on both large and small earthmoving jobs . . . The new "75" series, ¾ yd. Gar Wood shovels and famous "Buckeye" Ditchers are useful on any job!

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Construction Equipment: Excavators, Scrapers, Dozers, Ditchers, Spreaders, Finegraders, Truck-mounted Road Graders. Truck Equipment: Dump Truck Bodies & Hoists, Winches & Cranes, Refuse Collection Bodies, Elevating End Gates.

To obtain more information on products advertised see page E-45

NEWS

AGA Initiates New Financial Report

The American Gas Association has initiated a new reporting service that will help the business and financial community, as well as the gas industry itself, to obtain clear and frequent pictures of trends in expenses and earnings in the gas industry. Beginning with the 12 months ended March 31, 1952, the Bureau of Statistics of AGA will compile and publish a composite quarterly income statement for the entire gas distribution and pipe line industry. Included will be the most essential items of operating revenues, operating expenses and taxes, and net income.

The initial income statement shows that the total gas industry operating revenues for the 12 months ended March 31, 1952, were $3,130,000,000, compared with $3,047,000,000 in the preceding 12-month period and $2,634,000,000 for the like period ended March 31, 1950. This represents a gain in revenues of 18.8 per cent over the 1950 period. Net income after taxes and charges was almost unchanged, totaling $330,000,000 for the current 12-month period, against $340,000,000 a year earlier and $326,000,000 two years ago.

Increases in revenue have been absorbed principally by higher taxes and advancing operating costs. The latter category, including labor, materials, and purchased gas, is now 17.1 per cent higher than in the period ended 15 months ago, and accounts for 64.9 per cent of total operating revenues. Taxes as a group are 35.3 per cent higher than at the end of 1950, with federal income and excess profit taxes showing an increase of 46.9 per cent.

Total taxes for the year ended March 31, 1952, were $460,000,000, or 39.4 per cent higher than total net income. As a result of the industry's continued expansion program during 1951 and 1952, depreciation accruals and interest on long-term debt both increased significantly, the former being up 27.7 per cent and the latter 27.7 per cent over totals for the full year 1950.

Financial statistics compiled by the AGA refer to the operations of all gas utilities and pipe line companies. They are developed from reports of 150 companies, which represent between 75 and 80 per cent of total revenues from sales to consumers and from sales for resale.

The Federal Power Commission issues composite monthly income statements and balance sheets, but these refer only to that part of the industry subject to the commission's jurisdiction under the Natural Gas Act. No adjustments are made in the comparative years' data for changes in jurisdictional status, so that the respective statistics of the FPC may not always refer to the same group of companies.

The association's statements will report trends for 12-month periods ending with each quarter. Because of variations in climatic conditions, heating loads, and other factors, the analytical uses of three-month financial data would be limited.

Another basic difference between the AGA and the FPC reports concerns the handling of "below the line" items for combination gas and electric companies. The FPC includes in its monthly tabulations only those combination utilities deriving at least 50 per cent of their income from natural gas. For these companies all income deductions are attributed to gas operations. To avoid this, AGA has separated all deductions for combination companies based on relative amount of gas plant and other utility plant, as this appears to be the most equitable method of segregating these accounts. This method would be unwarranted for single companies but compensates when applied to the entire industry.

Composite gas industry income statements follows:

Total gas industry income statement (millions).

	1950	1951	Twelve months ended March 31, 1952
Total operating revenues	$2,634	$3,047	$3,130
Operating expenses-operation	1,596	1,828	1,860
Operating expenses-maintenance	137	146	170
Operating expenses — total	1,733	1,974	2,030
Depreciation, retirement, depletion, amortization, etc.	181	214	220
Federal income and excess profit tax	177	256	260
All other taxes	163	177	210
Total taxes	340	433	460
Total operating revenue deductions	2,254	2,621	2,710
Net operating revenues	380	426	420
Other income	36	31	30
Gross income	416	457	450
Interest on long-term debt	95	113	120
Other income deductions	(4)	4	†
Total income deductions	90	117	120
New income	326	340	330

† Less than 5 million.

Sinclair Constructing Five New Terminals

Sinclair Refining Company is constructing four new terminals having a total of 430,000 bbl of tankage for gasoline and light fuels storage along the Plantation Pipe Line Company's products pipe line system, and one on the Southeastern Pipe Line Company's products pipe line having a total of 95,000 bbl of tankage for gasoline and light fuels storage. The company estimates the cost of these facilities will be approximately $2,200,000.

On the Plantation line the terminals will be at Greensboro and Charlotte, North Carolina; Birmingham, Alabama, and Meridian, Mississippi. On the Southeastern line the terminal will be just outside Atlanta, Georgia.

Present plans call for completion of construction early in November.

Northeastern Will Not Get Gas From Transcontinental

The Federal Power Commission has revoked the authority contained in an order of November 8, 1950, for Transcontinental Gas Pipe Line Corporation, of Houston, Texas, to deliver 64,000,000 cu ft of natural gas a day to Northeastern Gas Transmission Company, of Springfield, Massachusetts, for resale in New England.

Transcontinental filed a petition with the FPC last February requesting that the November, 1950, order be modified to rescind the authority for the sale and delivery of gas to Northeastern. This matter subsequently was consolidated for hearing with several other proceedings including Transcontinental's plan for permanent disposition of this 64,000,000 cu ft of gas to other customers.

After Transcontinental received the November, 1950, authorization for the New England lateral, it entered into an agreement with Northeastern under which deliveries were scheduled to begin by September 1, 1951. However, because of an increase in the estimated cost of the lateral, Transcontinental said, it was unable to raise the funds in the manner proposed. In addition, Transcontinental said that it did not have pipe available and was faced with litigation on the condemnation of a compressor station site in Rye, New York.

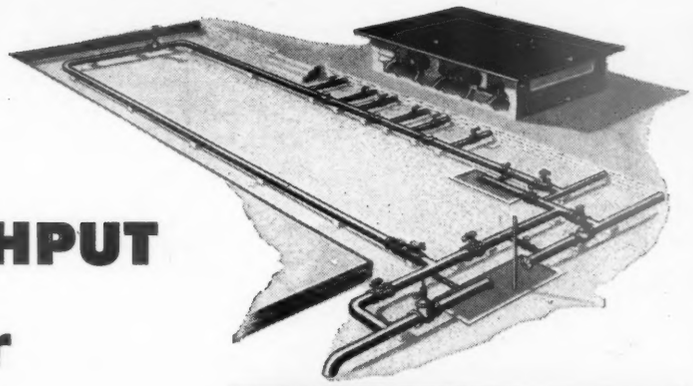
Transcontinental said that after this was explained to Northeastern, the latter company in turn stated that it probably would not be able to take gas until September of 1952. Transcontinental said it subsequently terminated the Northeastern contract, after which that company advised it that it considered that Transcontinental had breached the contract, and that it did not care to enter in a new contract as proposed by Transcontinental.

In revoking the authority, the FPC pointed out that the evidence shows that Transcontinental does not at the present time have any intent to construct the New England lateral, and that it apparently would be futile for the commission to attempt to require construction of the facilities.

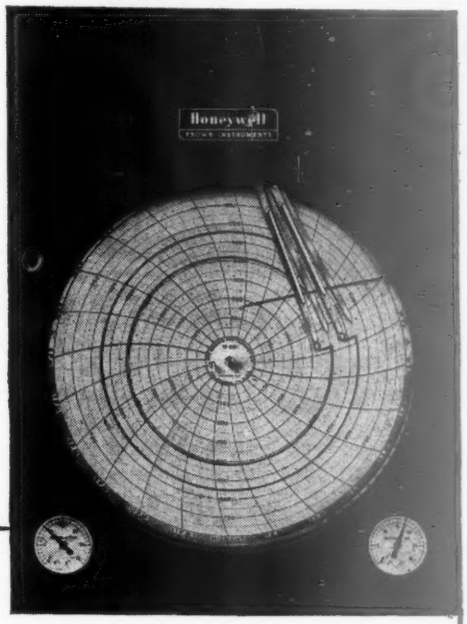
The FPC asserted that without the supply of gas to Northeastern through Transcontinental facilities, the resulting deficiency must be met otherwise or an impairment of Northeastern's ability to render service would result.

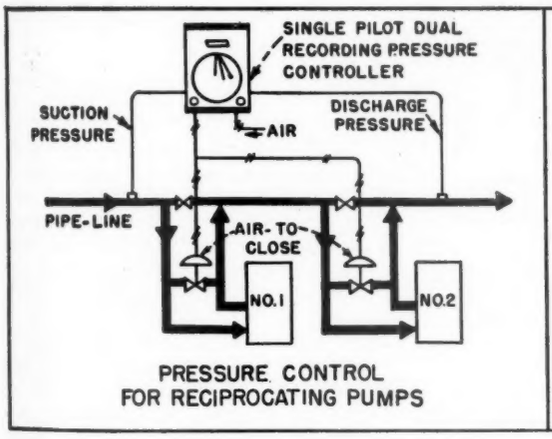
The commission noted, in this connection, that it simultaneously adopted an order authorizing, among other things, the delivery of 64,000,000 cu ft of natural gas a day to Northeastern by Tennessee Gas Transmission Company, of Houston, Texas.

For GREATER THROUGHPUT in Crude Oil or Products Pipelines

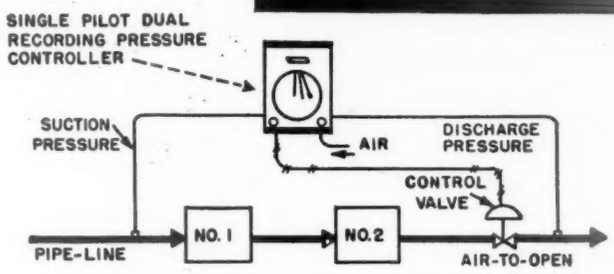


...THE BROWN SINGLE-PILOT DUAL CONTROLLER





PRESSURE CONTROL
FOR RECIPROCATING PUMPS



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The transfer of control from one pressure to the other is automatic and smooth . . . and control set points are easily adjusted to individual system requirements. While proportional control is recommended, either control unit of the instrument can be of any standard control form. A single integral control by-pass can be supplied for manual control at the operator's discretion.

The two diagrams show typical arrangements for the use of this instrument with centrifugal and reciprocating pumps. For more detailed information, write for a copy of Data Sheet #7.2-1 or call in your local Honeywell engineer . . . he is as near as your phone. Minneapolis-Honeywell Regulator Co., *Industrial Division*, 4475 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

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Parallel-reinforced VITRON Wrap improves distribution of coating, reduces holidays, and means longer life for your pipe coating.

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UNDERGROUND PIPE WRAP

Gas Industry Will Spend 5.6 Billion in Next 5 Years

The nation's gas distribution and pipe line industry will spend about $5.6 billion for construction of new facilities and expansion of plant in the five-year period extending from 1952 through 1956, the American Gas Association estimates. This compares with construction expenditures of 5.1 billion dollars during the last five years, a previous high record in the gas industry.

The natural gas branch of the industry expects to spend $5,099,000,000 in its five-year expansion program, compared with $4,560,000,000 in the 1947-1951 period. Expanded transmission facilities will cost an estimated $3,075,000,000 in the next five years, with $415,000,000 allocated to production facilities and an additional $82,000,000 estimated for underground storage expansion.

All other types of gas will account for about $500,000,000 in new construction in the next five years. Expanded distribution facilities will cost an estimated $.02,000,000, and $150,000,000 will go toward production and storage facilities.

The association reports that despite shortages of essential pipe and other materials the gas industry expended a record $1,461,500,000 in 1951 for construction of new facilities. This sum exceeds the previous peak established in 1950 by $263,200,000, or 22 per cent.

Indications are that there will be a temporary slackening of construction expenditures during 1952 because of continued allocation and material difficulties; however, the estimated expenditure of $1.17 billion in 1952 still represents the third greatest annual expenditure in gas industry history. A number of major pipe lines were completed in 1951 and augmented capacity of the nation's pipe line system in 1952 will be accomplished to a greater extent than before, through installation of additional compressor, rather than pipe, facilities.

Current plans indicate that the record established in 1951 may be broken in 1953, when estimated construction expenditures total $1,681,000,000. This estimate reflects plans for major expansions of existing systems to begin in 1953, as well as one new pipe line from the Gulf Coast area to the Middle West and the initiation of a natural gas pipe line, either from Canada or the Southwest, to serve the Pacific Northwest.

Substantial completion of such projects contributes to the sustained high level of anticipated expenditures, estimated at $1,206,000,000 in 1954. Expectations for the fourth and fifth years of the period reveal decreases, though prior estimates for the more remote years have consistently understated subsequent actual expenditures.

Companies accounting for $2.1 billion of the total anticipated $5.6 billion have indicated their plans concerning financing their construction programs. These companies indicated they expected to obtain 34.6 per cent of the required funds from internal sources, primarily undistributed earnings and depreciation accruals. Of the remaining 63.4 per cent to be obtained from outside sources, about 46 per cent will be realized through long term debt and 19.4 per cent from common or preferred stock issues.

The actual expenditures in 1951 and projected expenditures in 1952 are based on reports submitted to AGA by companies representing over 95 per cent of total revenues of the industry. Forecasts beyond 1952 are the result of a special annual survey by the association's bureau of statistics, among a substantial number of pipe line and large distribution companies.

The accompanying table gives statistical details of projected expenditures from 1951-56.

Gas utility construction expenditures, by type of gas and by plant function, 1951-1956.

(Millions)

Type of gas and plant function	Actua 1951	Forecast 1952	1953	1954	1955	1956	Total forecast 1952-1956	Total actual 1947-1951
Natural gas, total	$1,363	$1,067	$1,571	$1,206	$645	$610	$5,099	$4,560
Production	124	91	102	72	75	75	415	511
Transmission	867	607	1,133	820	275	240	3,075	2,939
Underground storage	42	40	20	12	5	5	82	*
Other storage	15	5	6	12	10	5	38	*
Distribution	271	279	279	264	255	260	1,337	958
General	44	45	31	26	25	25	152	152
All other types of gas, total	98	106	110	98	91	91	496	586
Production and storage	19	31	39	29	23	28	150	221
Transmission	6	1	2	2	4	2	11	23
Distribution	66	70	62	61	55	54	302	314
General	7	4	7	6	9	7	33	28
Total industry, total	1,461	1,173	1,681	1,304	736	701	5,595	5,146
Production and other storage	158	127	147	113	108	108	603	732
Transmission	873	608	1,135	822	279	242	3,086	2,962
Underground storage	42	40	20	12	5	5	82	*
Distribution	337	349	341	325	310	314	1,639	1,272
General	51	49	38	32	34	32	185	180

* Included in production.

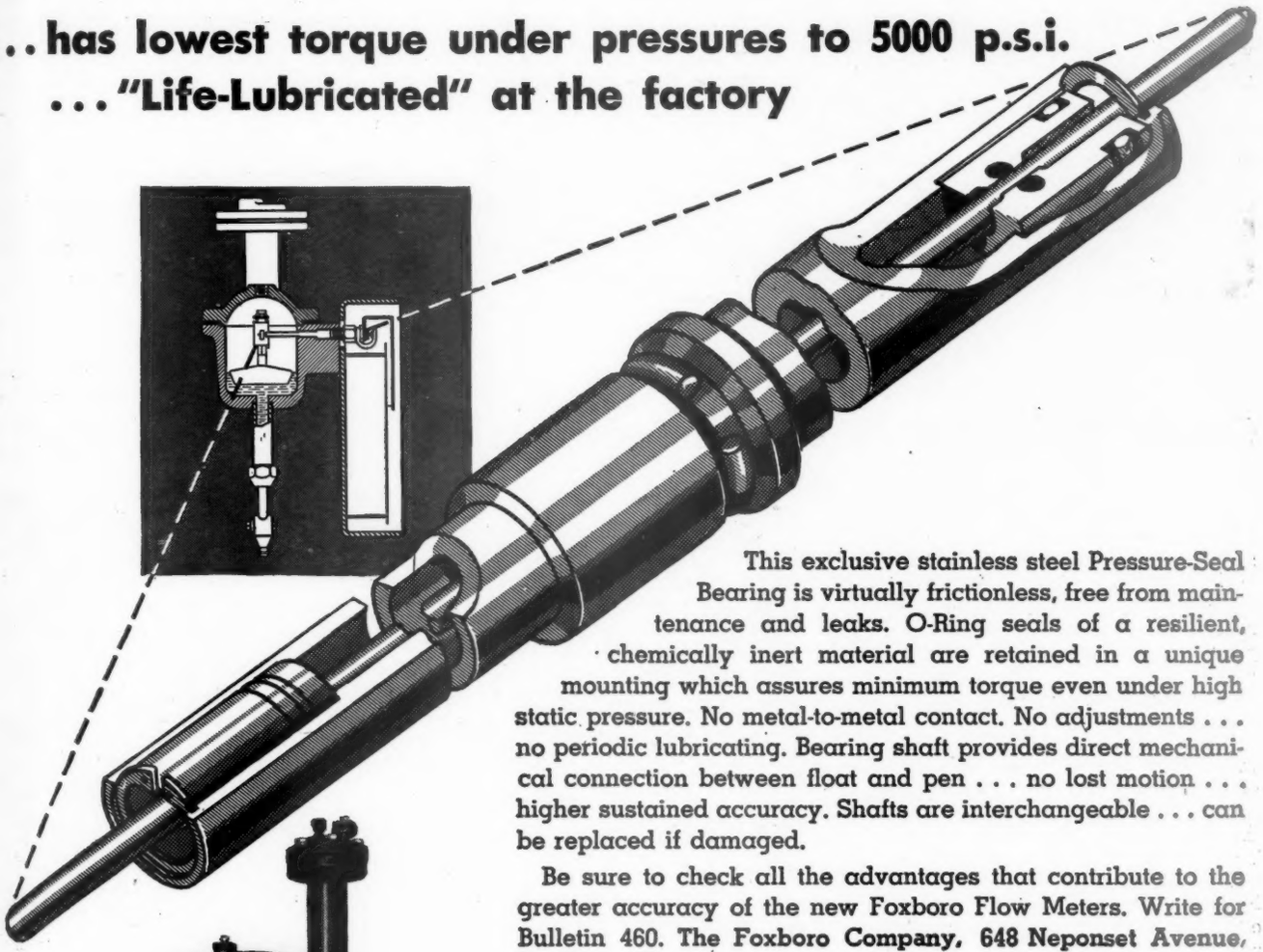
Buchanan Named on FPC

Thomas C. Buchanan, who was given an interim appointment and designated chairman of the Federal Power Commission by President Truman, has taken the oath of office as a member of the commission. The oath was administered by Commissioner Dale E. Doty.

Buchanan, a native of Beaver, Pennsylvania, served as chairman of the commission from January 5, 1952, until the expiration of his term on June 22. He has been a member of the commission since July 14, 1948.

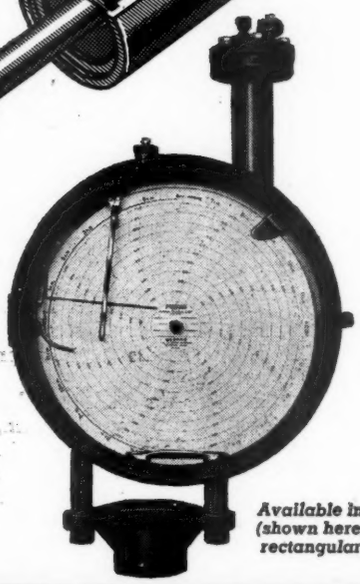
You've never seen a meter bearing as trouble-free!

...has lowest torque under pressures to 5000 p.s.i.
..."Life-Lubricated" at the factory



This exclusive stainless steel Pressure-Seal Bearing is virtually frictionless, free from maintenance and leaks. O-Ring seals of a resilient, chemically inert material are retained in a unique mounting which assures minimum torque even under high static pressure. No metal-to-metal contact. No adjustments . . . no periodic lubricating. Bearing shaft provides direct mechanical connection between float and pen . . . no lost motion . . . higher sustained accuracy. Shafts are interchangeable . . . can be replaced if damaged.

Be sure to check all the advantages that contribute to the greater accuracy of the new Foxboro Flow Meters. Write for Bulletin 460. The **Foxboro Company, 648 Neponset Avenue, Foxboro, Massachusetts.**



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- **Sure-Seal Check Floats** insure perfect seating; submerged in mercury to prevent frosting and fouling.
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- **Calibrated Damping Plug** fully adjustable under pressure.

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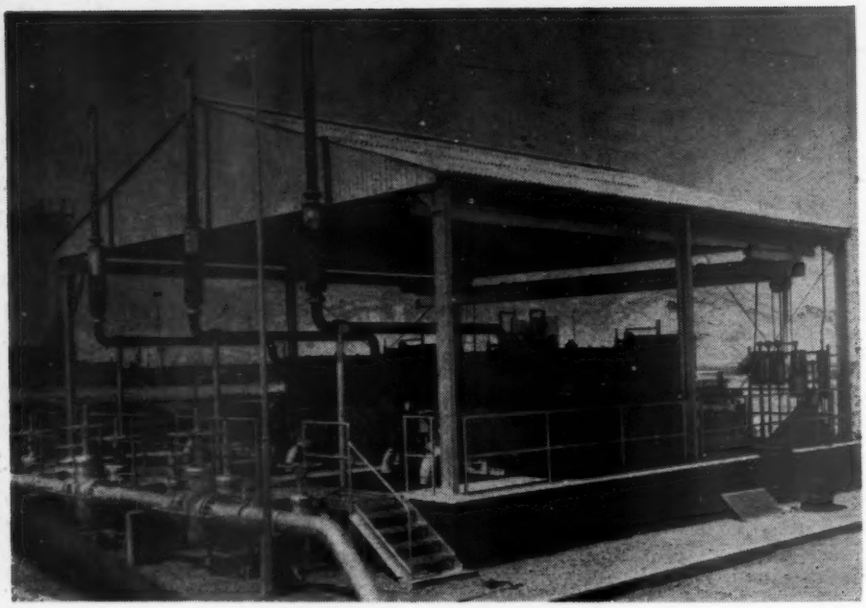
FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND



Inspection report of engine wear.

Engine number.....	1	2	3
Engine operating hours from June 1951 to March 1952	4812	5293	6881
Liner wear after 3552 hours			
4 in. from top.....	0.002	0.002	
10 in. from top.....	0.001	0.001	
3 in. from bottom.....	.....	.....	
Flywheel deflection.....	0.00125	Original	
Liner wear after 5275 hours			
4 in. from top.....			0.001 to 0.003
10 in. from top.....			0.001
Flywheel deflection.....			0.00025

Running at 600 rpm, three 320-hp National Supply Atlas diesels operate on crude oil to drive booster pumps in an oil-line station of the Richfield Oil Corporation of Cuayama Valley, California.

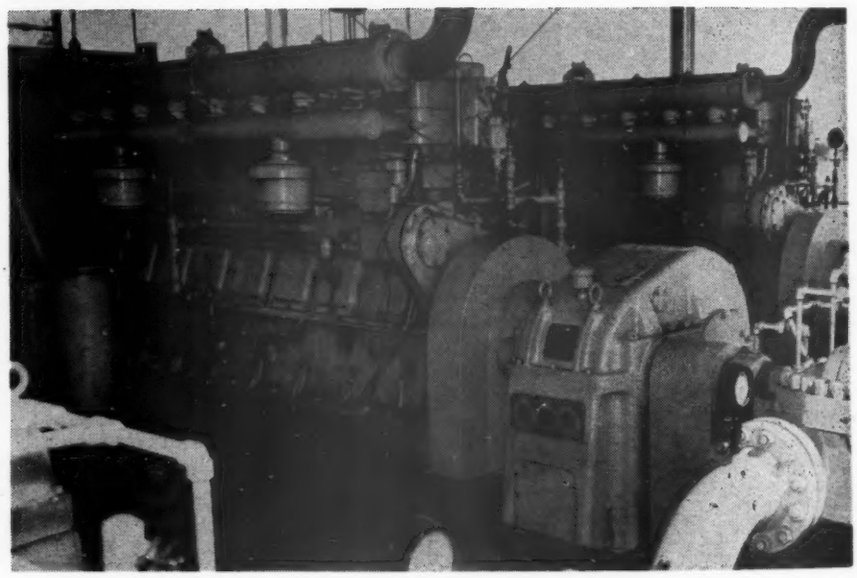
Diesel engines connect to the booster pumps through a speed increaser fitted with a flexible coupling on each end.

Crude Oil Used as Diesel Fuel

Boosting crude oil pressure in a Richfield Oil Corporation, transmission pipe line running through the Cuayama Valley in California, is the job of three National Supply Company Atlas diesels. Each of the three pumps, which are piped in series, is driven by a Model 45, 8-cylinder, 4-cycle engine using crude oil for fuel and developing 320 hp at 600 rpm.

The engines are connected to Byron Jackson centrifugal pumps through Pacific Western speed increasers. The speed increasers have 18-in. Falk flexible couplings on the engine side and Thomas couplings on the pump side.

The small amount of wear evidenced by figures shown in the inspection record indicates that the crude-oil fuel is satisfactory from an abrasive standpoint. The crude is centrifuged, but not heated. Lubricating oil is heavy-duty SAE-30.



Texas-California Oil Line Approved

The Petroleum Administration for Defense has given full approval for construction of a 24-in., 953-mile crude oil pipe line between Wink, Texas, and Norwalk, California, L. M. Glasco, president of the West Coast Pipeline Company of Dallas, announced.

Arrangements for purchases of line pipe have been completed with Consolidated Western Steel Company and Kaiser Steel Company together with A. O. Smith. The financing, totaling about $101,000,000, is being arranged by White, Weld and Company, and Union Securities Corporation, both of New York, acting on a full report on the project from Ebasco Services, Inc., of New York.

Construction is scheduled to begin in the fourth quarter of this year and the Petroleum Administration for Defense has authorized the purchase of 59,000 tons of pipe in the quarter, enough pipe to permit the laying of approximately 275 miles of line.

The PAD, in April, recommended rapid tax amortization of 25 per cent of the cost of the line on a finding that the pipe line would contribute to national defense. At that time it delayed full approval of construction until all engineering details on the line could be submitted to it. Final approval and a promise of priorities assistance on needed materials and equipment were granted July 11.

The plans for the line call for a 24-in. pipe line with four pumping stations having a capacity of 100,000 bbl a day. The capacity could be increased to 300,000 bbl a day on installation of 12 pumping stations. The route of the line will permit deliveries to a proposed oil refinery at Florence, Arizona, and to El Paso, Texas, refineries as well as those in California.

Cost of the project with a capacity of 100,000 bbl a day is estimated at $79,500,000; with a capacity of 200,000 bbl, $99,600,000; with a maximum capacity of 300,000 bbl a day, $105,700,000.

Completion of the line is scheduled for the third quarter of 1953.

New Mexico Headquarters Established by Service

Service Pipe Line Company's expanding operations in New Mexico are now being supervised from a new district headquarters at Lovington, C. E. Wilson, West Texas division manager at Lubbock, announces. The change was made July 1.

An office building and warehouse have been constructed in Lovington. James C. Dotson, former division gager of Denver City, Texas, is in charge of the new office as district superintendent.

Connected to 285 wells on 166 leases in Lea County, Service Pipe Line Company completed July 1 a new 26-mile, 10-in. line from the Saunders pool to the Denton pool and thence to its West Texas system.

Sixteen more Service Pipe Line Company employees have been moved to Lovington. A number of gagers previously had moved to new homes in Lea County. A connection crew under the supervision of Mack W. Lancaster, formerly of Denver City, and four office workers, were transferred from other West Texas division points. Russell L. Reasoner has been promoted to division gager to replace James C. Dotson.

On a 200-ft by 300-ft plot of ground, the company has a 30-ft by 30-ft air-conditioned office building and a 40-ft by 120-ft quonset warehouse. The building was erected by Fine Homes, Inc., of Lubbock. The large plot of ground will be used as a pipe storage point.

The Saunders pool has been served by a company line that pumps oil north to a line serving the Caprock area. The new Saunders-Denton line moves oil east to the company's Wasson pump station.

C. M. Scott, Jr., general manager, described the new construction as "a big gathering line that will act as a loop also for our northern line in Lea County."

The new line will provide adequate capacity for future production in the vicinity of the Saunders and West Saunders pools, and for new development along the route. There is considerable drilling activity in the region.

The construction will give Service Pipe Line Company an extensive gathering and transportation system in northern Lea County. Lines now run from Caprock to the company's West Texas system at Slaughter station with laterals serving the Bagtower, Saunders, and Gladiola pools. A Magnolia Pipe Line Company gathering system serving the Crossroads pool is connected to the Caprock-Slaughter line also. A line runs from the Knowles pool across the Texas line to Wasson. The Denton pool already is connected to the West Texas system. Thirty of the Lea County wells are in the Eaves pool in the company's Monahan's district.

During the past year Service Pipe Line Company, a 12,128-mile crude oil system, has connected 92 new fields and pools largely in Texas and New Mexico. Most of the oil gathered by the company in the southwest is delivered to refineries in the Kansas City, St. Louis, and Chicago areas.

Lone Star Completing Enlargement Program

The Lone Star Gas Company is constructing, and will have completed about July 15, pipe lines that will deliver gas into its system from the new Donie field in south Freestone County, Texas, and increase delivery capacity in a major transmission line supplying Waco and points south, according to Luther Tolbert of Dallas, superintendent of pipe lines. Total cost of the project will exceed $750,000.

The first phase of the work is the laying of 17 miles of 16-in. pipe, starting at Lone Star's compressor station north of Groesbeck in Limestone County and extending east to a point south of Teague in Freestone County. Providing enlarged delivery capacity, the 17-mile section will replace 12-in. pipe in Lone Star's dual system of 12-in. and 20-in. pipe extending 70 miles east from Waco and terminating near Dew in Freestone County. Here the dual lines revert to a single line of 12-in. diam connected to gas fields in Anderson County.

From the east end of the new 17-mile replacement line, Lone Star will drop south with 3 miles of 12-in. pipe to make a connection with the gas supply in the new Donie field. At present the company has access to more than 5,000.000 cu ft of gas daily from the Donie field and the supply will be stepped-up with the drilling of additional wells in the field. The increased availability will strengthen the gas supply for Mexia, Teague, Groesbeck, and other points in the area.

Third phase of the construction program calls for the laying of 10 miles of 12-in. pipe from Lone Star's compressor station at Waco to Riesel in McLennan County. This will form Lone Star's third 12-in. parallel line between the two towns and it will provide enlarged facilities for transmitting gas from the Anderson County and Donie fields to Waco and towns south.

Mexia is headquarters for the construction project, which is under the supervision of Vaughn Sears, Lone Star construction foreman. More than 40 men are assigned to the work, representing regular crews and key men from the gas company personnel plus special workmen recruited from the Mexia-Groesbeck-Teague areas.

El Paso Natural Creates Operations Department

Estin Scearce

J. F. Eichelmann

W. H. Miller

R. W. Harris

Four employees of El Paso Natural Gas Company have been promoted into major executive positions in a recently created Operations Department by the company. The department has its headquarters in the company's home offices in El Paso, Texas.

Estin Scearce has been named operations manager of the Permian Division. This division includes all plants, field lines, wells, transmission lines, and other properties of the company in the Permian Basin in southeastern New Mexico and central Texas and in the Hugoton field in the north Texas Panhandle. Scearce has been employed by El Paso Natural for 21 years. Immediately prior to his promotion he was superintendent of the company's Jal Division with headquarters in Jal, New Mexico.

W. H. Miller has been named operations manager of the Southern Division. The Southern Division includes the mainlines and lateral lines and the mainline compressor stations of the company west of the Pecos River and carrying gas from the Permian Basin. It extends to the Arizona-California border. Miller has been an employee of El Paso Natural for 21 years. Before his promotion, he was superintendent of mainline compressor stations.

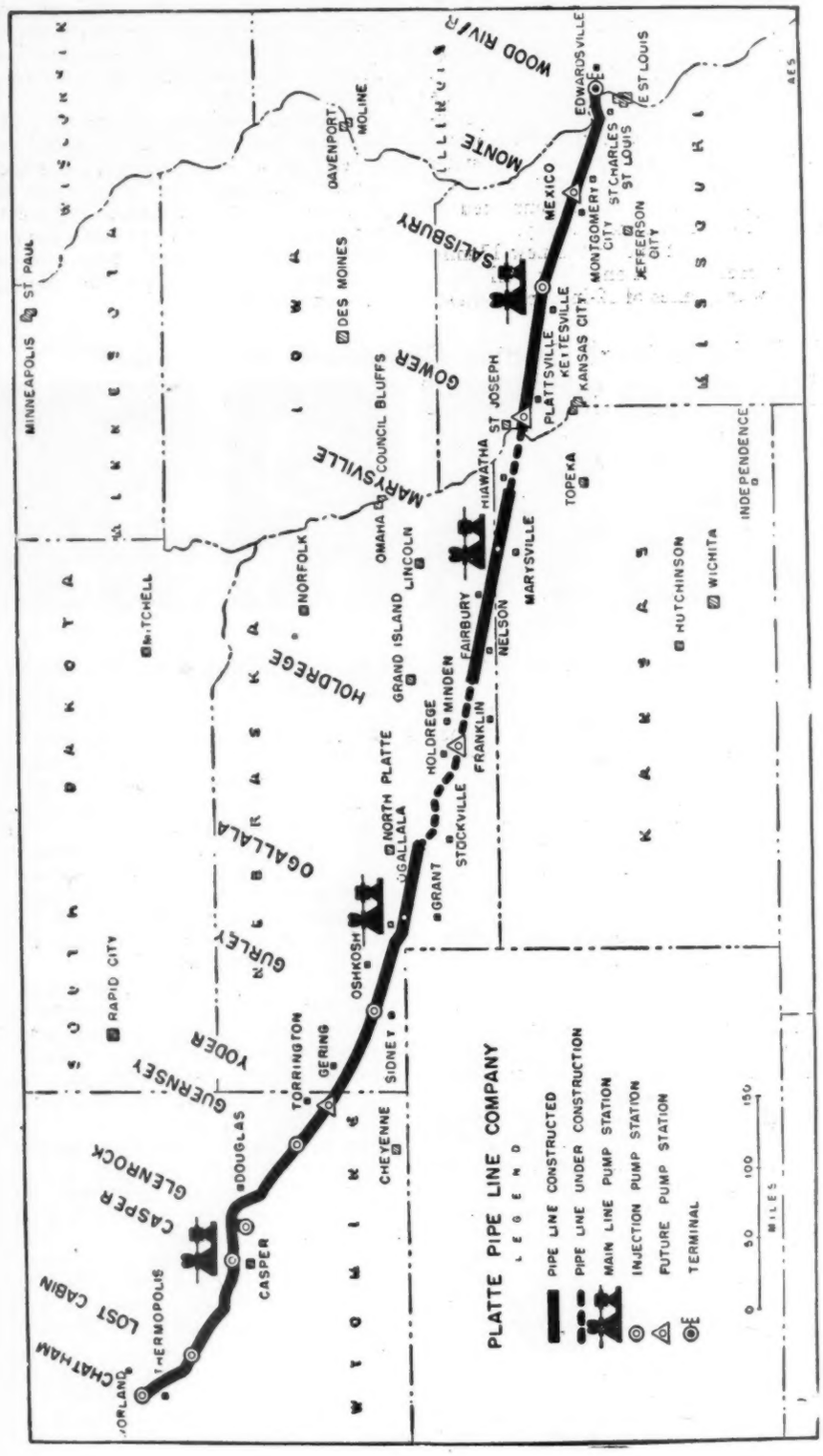
R. W. Harris has been promoted to operations manager of the San Juan Division. This division extends for 450 miles from northwestern New Mexico and southwestern Colorado across northern Arizona to the California border. The division includes all properties of the company in both the gas fields of the San Juan Basin and the mainline transmission facilities from those fields. Harris has had 21 years' service with El Paso Natural. He was superintendent of the San Juan Division with offices in Farmington, New Mexico, immediately preceding his promotion. He will also be in charge of the company's pipe line construction program.

J. F. Eichelmann, chief engineer, has been placed in charge of coordinating engineering matters among the engineering, operations, and construction departments of the company. He will also consult with the contract department on matters involving engineering. Eichelmann has been with El Paso Natural Gas Company for 21 years.

The creation of the Operations Department is the result of the vastly expanded activities of the company during the last several years. El Paso Natural Gas Company today delivers 1,200,000,000 cu ft of gas a day throughout West Texas, New Mexico, Arizona, northern Mexico, and California. It is now engaged in construction that will increase these deliveries to more than 1,600,000,000 cu ft a day and will provide service to southern Nevada.

Steel Strike to Delay Platte Line Completion

The steel strike has already had the effect of seriously delaying the completion of the Platte Pipe Line, the 1000 miles of 20-in. pipe line being constructed to transport Rocky Mountain crude oil to the St. Louis and Chicago consuming areas. Two construction crews were shut down when they completed welding the last of the pipe on hand. A third construction crew had approximately 30 miles of pipe, which would keep it active for about a week into August. When all the pipe now on hand is installed, there will remain two unfinished gaps in the pipe line, one of 45 miles in northeast Kansas and another of 85 miles in Nebraska west of the company's pump station near Holdrege.



The Platte Pipe Line had been scheduled for completion about September 1, but the steel strike will cause the completion to be substantially delayed. Although the delay will cause Platte Pipe Line Company to suffer considerable additional direct costs, the indirect cost to the Rocky Mountain area generally is more significant. When completed, the line will transport 100,000 bbl of oil per day to Eastern markets. Even assuming a conservative price of $2.00 per bbl, each day's delay in completion of the line means that the Rocky Mountain oil industry loses $200,000 in 1952 oil sales. The delay in commencing this revenue will also have the effect of retarding the search for new oil fields in the Rocky Mountains.

Until the steel strike is settled, no estimate can be made regarding when the pipe line will be completed. It will take several weeks to recharge the supply lines from the steel mills to the pipe fabricating mills and to the field construction sites. It will probably be four or five weeks after the strike ends before construction can be resumed; and after construction is resumed, 10 or 12 weeks more will be required to finish it.

The Platte Pipe Line will provide the transportation outlet that the Rocky Mountain oil industry has so long needed. Its early completion is supported by the Petroleum Administration for Defense as being essential to make Rocky Mountain oil available to the nation's oil mobilization program.

IGT Graduates Largest Class in School's History

A doctor and 14 masters of gas technology composed the June, 1952, graduating class of the Institute of Gas Technology, the gas industry's own educational and research facility. The men received their degrees from the Graduate School of Illinois Institute of Technology, with which IGT is affiliated.

The doctor is Rex T. Ellington, Jr., a native of Gunnison, Colorado. He is the third man in the history of IGT to earn a PhD majoring in gas technology. Dr. Ellington has gone to work for the Chattanooga Gas Company.

The masters of gas technology and their employers are: John R. Bruns, Laclede Gas Company; Thomas R. Campbell, The East Ohio Gas Company; John L. Denton, Globe American Corporation; Philip A. Dieffenbach, Laclede Gas Company; Robert L. Hays, North Shore Gas Company; Evan C. Kovacic, Central Hudson Gas and Electric Corporation; Robert F. McNamara, Ford, Bacon and Davis, Inc.; Loren N. Miller, Honolulu Gas Company, Ltd.; Daniel S. Ortiz, Seattle Gas Company; Kenneth D. Raven, Texas Illinois Natural Gas Pipeline Company; Russell A. Sault, Public Service Company of Northern Illinois; Robert D. Sickafoose, The Peoples Gas Light and Coke Company; Paul E. Smith, New York State Natural Gas Corporation; James R. Stewart, Jr., United Gas.

AGA Nominates Officers, Directors, Committee Chairmen

Thirty-one gas industry executives from 16 states and the District of Columbia have been nominated for election as officers, directors, and chairmen of sections and general committees of the American Gas Association. Directors will be elected for two-year terms expiring in 1954. Association officers, section chairmen, and vice-chairmen, and chairmen of general committees will be elected for the 1952-1953 year.

Nominees will be voted upon at the 1952 AGA convention at Atlantic City, New Jersey, October 27-30. The list of candidates for election will be placed before the membership by a general nominating committee elected at the association's 1951 convention at St. Louis, October 15-17. Any 50 company members of the association can submit additional nominations by placing them in the hands of the association's managing director by August 27, 1952.

The general nominating committee presenting this year's slate includes: E. M. Borger, The Peoples Natural Gas Company, Pittsburgh, chairman; Frank H. Adams, Surface Combustion Corporation, Toledo; Paul R. Buchanan, The Hartford (Connecticut) Gas Company; N. Henry Gellert, Seattle Gas Company; Robert W. Hendee. Colorado Interstate Gas Company, Colorado Springs, and Claude A. Williams, Transcontinental Gas Pipe Line Corporation, Houston.

The following nominations were made:

For president—Frank C. Smith, president, Houston Natural Gas Corporation, Houston, Texas.

For first vice president—Earl H. Eacker, president, Boston Consolidated Gas Company, Boston, Massachusetts.

For second vice president—F. M. Banks, president and general manager, Southern California Gas Company, Los Angeles, California.

For treasurer—Edward F. Barrett, president, Long Island Lighting Company, Mineola, New York.

For director, two-year term expiring October, 1954:

E. R. Acker, president, Central Hudson Gas and Electric Corporation, Poughkeepsie, New York.

L. B. Bonnett, vice president, Consolidated Edison Company of New York, Inc., New York.

Everett J. Boothby, president, Washington Gas Light Company, Washington, D. C.

Dudley B. W. Brown, president, Milwaukee Gas Light Company, Milwaukee, Wisconsin.

A. W. Conover, president, Equitable Gas Company, Pittsburgh, Pennsylvania; N. Henry Gellert, president, Seattle Gas Company, Seattle, Washington; Lyle C. Harvey, president and general manager, Affiliated Gas Equipment, Inc., Cleveland, Ohio.

Frederic O. Hess, president, Selas Corporation of America, Philadelphia, Pennsylvania.

Robert A. Hornby, executive vice president, Pacific Lighting Corporation, San Francisco, California.

Paul Kayser, president, El Paso Natural Gas Company, Houston, Texas.

James F. Oates, Jr., chairman, The Peoples Gas Light and Coke Company, Chicago, Illinois.

William T. Stevenson, president, Western Kentucky Gas Company, Owensboro, Kentucky.

R. G. Taber, president, Atlanta Gas Light Company, Atlanta, Georgia.

George E. Whitwell, vice president in charge of sales, Philadelphia Electric Company, Philadelphia, Pennsylvania.

Charles G. Young, president, Springfield Gas Light Company, Springfield, Massachusetts.

Accounting section:

For chairman—Bernard S. Rodey, Jr., assistant secretary, Consolidated Edison Company of New York, Inc., New York.

For vice chairman—Paul E. Ewers, commercial office manager, Michigan Consolidated Gas Company, Detroit, Michigan.

Industrial and Commercial Gas Section:

For chairman—Terry Hart, general sales manager, Nashville Gas Company, Nashville, Tennessee.

For vice chairman—C. C. Eeles, district sales manager, The Ohio Fuel Gas Company, Columbus, Ohio.

Residential Gas Section:

For chairman—R. J. Vandagriff, general sales manager, Laclede Gas Company, St. Louis, Missouri.

For vice chairman—Raymond Little, general sales manager, Equitable Gas Company, Pittsburgh, Pennsylvania.

Operating Section:

For chairman—Channing W. Wilson, research chemist, Consolidated Gas Electric Light and Power Company of Baltimore, Maryland.

For vice chairman — Frederick J. Pfluke, superintendent-gas operations, Rochester Gas and Electric Corporation, Rochester, New York.

Manufacturers Section:

For chairman—Gordon Lefebvre, president, The Cooper-Bessemer Corporation, Mt. Vernon, Ohio.

Publicity and Advertising Committee:

For chairman—Willis M. Kimball, director of information, The Columbia Gas System, Inc., New York, New York.

Laboratories Managing Committee:

For chairman — Arthur F. Bridge, president and general manager, Southern Counties Gas Company, Los Angeles, California.

For vice chairman—Clarence H. Waring, vice president, The Gas Service Company, Kansas City, Kansas.

Two Long Water Crossings Installed

Gunite-covered pipe for water crossing at Copano Bay, near Corpus Christi.

Long water crossings were the tough problems faced by Altgelt Construction Company of Corpus Christi, Texas, in constructing a 30-mile, 12-in. natural gas pipe line from the St. Charles, Arkansas County, Texas, field to the Reynolds Metal plant north of Corpus Christi.

Contractor used crawler tractors, winches, and dollies riding on specially laid rails to effect a 6000-ft water crossing at St. Charles and a 12,000-ft crossing at Copano Bay.

Altgelt lined up 1000-ft sections of the gunite-covered pipe used for the underwater stretches at each point of crossing. Sideboom tractors then placed the rails for the dollies to ride on and the tractors transferred the pipe sections to the dollies. While the tractors pushed the pipe along the rails into the water, a winch line pulled the pipe from the opposite side. As each pipe section was submerged, another section was joined to it. Tie-ins were made at each side of the water.

The gunite-covered pipe used in the underwater work weighed approximately 150,000 lb per 1000-ft section. These sections were lined up and handled by two International TD-14A crawlers and an International TD D, all equipped with Superior sidebooms.

This unit of four Fram Filters serves two 500 hp air injection Fulton Diesels in large eastern quarry. Another unit of three Fram Filters protects 1000 hp solid injection Fulton Diesel from harmful quarry grit and dust.

FRAM FILTERS Protect Vital Diesel Engines from Quarry Contaminants

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The quarry's chief engineer is plenty enthusiastic about time- and money-saving Fram Filters —says all his diesels must be Fram-equipped for maximum service.

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PAD Simplifies Reporting on Construction Progress

Procedures for reporting on the progress of approved oil and gas projects have been simplified to lessen operators' work, Deputy Petroleum Administrator J. Ed Warren announces.

In the past operators undertaking a project that uses more than $500,000 in materials and equipment have been required to file with the Petroleum Administration for Defense monthly a detailed report on their use of controlled materials and critical equipment. They now will be required only to make a general progress report on Section I of PAD-26 Supplement. This section calls for a report on the following items:

1. Engineering and design
2. Receipt of controlled materials
3. Receipt of critical equipment
4. Receipt of Class "B" items of machinery and equipment
5. Receipt of process towers and vessels (if any)
6. Construction of entire project.

Because the line pipe situation is critical as a result of the steel strike, the Gas Facilities Division of PAD requires that one copy of all purchase orders covering line pipe for recently approved PAD-26 projects be sent to the agency within 48 hours after the order has been accepted by the mill. The division also requires this report on all purchase orders for line pipe covering previous PAD-26 projects placed since the filing of Form PAD-73.

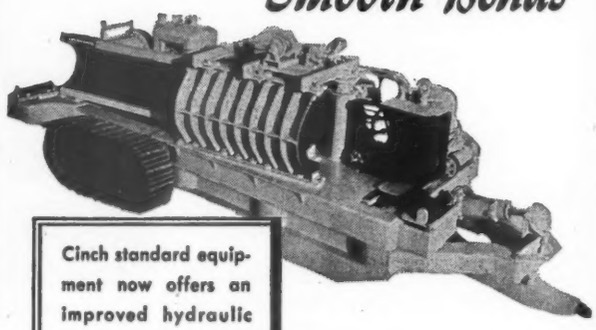
Form PAD-26 Supplement must be filed monthly from the time a project is begun until it is fully completed.

Ohio Pipe Line Names Division Superintendent

K. E. Tappy has been appointed superintendent of the Lima, Ohio, division of The Ohio Oil Company's Pipe Line Department, succeeding the late P. E. Thompson, it has been announced by O. F. Moore, manager of pipe lines. Tappy has served as assistant division superintendent at Lima since 1940. Tappy joined Ohio Oil in 1935 as an assistant foreman at Bluffton, Indiana. He was made an assistant line foreman in 1938, and promoted to foreman in 1939. Later that year, he was appointed chief engineer at Lima.

CINCH

Affords Faster, Smooth Bends



Cinch standard equipment now offers an improved hydraulic system and new wedge-type pin-up slide for greater durability and speed. If desired, even faster, easier maneuvering can be obtained with Athey tracks and hydraulic lift tongue.

Contractors swear by Cinch "Smooth Bend" Pipe Benders for dependability and uninterrupted service. Cinch Pipeline Equipment provides the most up-to-date equipment and expert maintenance.

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MOTOROLA 2-WAY RADIO SYSTEMS

maintain instant contact with repair crews, supervisory personnel and emergency operations

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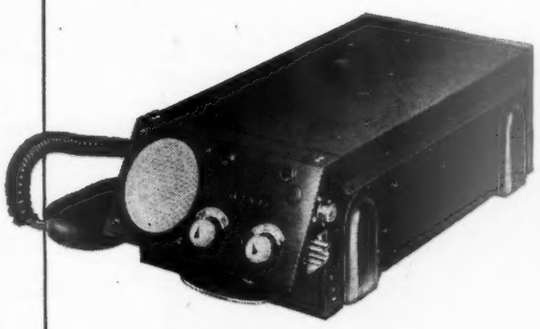
As an investment, too, Motorola puts first emphasis on your *profit interest.* The equipment is Motorola-engineered throughout to give you the biggest dollar's worth of top performance at the lowest maintenance cost on record. It also gives you the *protected* value of obsolescence-proof equipment.

UNI-CHANNEL

Portable Base Station Radio



Quickly set up anywhere for mobile or fixed station use, this unit delivers instant, dependable radio communication year after year. Optional power supply permits use of either 117 V, A.C. or 6 V, D.C. . . . just plug it in, connect antenna and go to work!

Permanently Tuned PERMAKAY FILTER

This unique Sensicon Permakay filter, an exclusive Motorola development, gives you sealed selectivity which permanently eliminates costly tuning adjustments.

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News

Hendee Elected President International Gas Union

Robert W. Hendee, president, Colorado Interstate Gas Company, Colorado Springs, Colorado, and former president of the American Gas Association, was elected president of the International Gas Union at the fifth International Gas Conference being held at Brussels, Belgium. The election of Hendee for a three year term expiring in 1955, marks the first time an American gas executive has been chosen to head this international organization, since the International Gas Union was formed 20 years ago.

Membership in the International Gas Union is composed of representatives of the leading gas associations from the principal nations of the world. The American Gas Association represents the United States in the International Union. Charles E. Bennett, president, The Manufacturers Light and Heat Company, Pittsburgh, and president of AGA, as well as H. Carl Wolf, managing director, AGA, were among the principal speakers at the conference.

Delegates from other nations attending the conference include representatives from Belgium, Canada, Czecho-Slovakia, Denmark, England, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, and Switzerland. Delegates approved an application for membership from the Japan Gas Association at the meeting. The international group meets once every three years.

New Tuscarora Pipe Line Nears Completion

The two-year, $10.000,000 reconstruction of the Tuscarora Oil Company's trans-Pennsylvania common-carrier pipe line is one step nearer completion with the opening of the 50-mile section between Freeport and Midland, western terminus of the line on the Ohio River.

The Pittsburgh branch, a 6-in. spur that joins the main 10-in. line 9 miles north of the city, will begin deliveries to Esso Standard Oil Company's storage facilities at Thirty-fifth Street in August, according to John W. de Groot, president of Tuscarora.

The entire program of replacing the 350-mile system with a modern 10 and 12-in. line on the main sections is expected to be completed in November. It will have an initial capacity of 42,000 bbl a day, which can be increased to 85,000 bbl. Terminals are near Reading, Harrisburg, Altoona, Indiana, and Midland.

The Tuscarora is the oldest commercial products pipe line. It has had a varied career in war and peace time as both a crude and products line. Originally established in 1908 as a crude oil carrier, it was converted to products in 1930, back to crude during the war and products again during the war.

Petroleum Radio Men Reelect Rhodes Chairman

H. A. Rhodes was reelected chairman of the National Petroleum Radio Frequency Coordinating Association at the annual meeting in Washington, D. C. He is superintendent of communications for Transcontinental Gas Pipe Line Corporation, Houston, Texas.

Other members of the executive committee for the NPRFCA elected at the meeting are L. E. Cook, Sinclair Pipe Line Company, Independence, Kansas, vice chairman; W. A. Shipman, Virginia Gas Transmission Company, Falls Church, Virginia, secretary; and C. D. Campbell, Humble Pipe Line Company, Houston, Texas, and Dr. R. D. Wyckoff, Gulf Oil Corporation, Pittsburgh, Pennsylvania.

Seven regional chairmen were elected at regional meetings held prior to the national meeting. The seven newly-elected chairmen are:

Region 1, D. K. Ruth, Manufacturers Light and Heat Company, 800 Union Trust Building, Pittsburgh, Pennsylvania.

Region 2, J. C. William, Ohio Fuel Gas Company, 99 North Front Street, Columbus, Ohio.

Region 3, D. R. Wofford, Texas Gas Transmission Corporation, Owensboro, Kentucky.

Region 4, McKinly Rhodes, Tennessee Gas Transmission Company, Houston, Texas.

Region 5, W. B. Haas, Northern Natural Gas Company, Omaha, Nebraska.

Region 6, T. A. Wilson, Southern Union Gas Company, P. O. Box 757, Farmington, New Mexico.

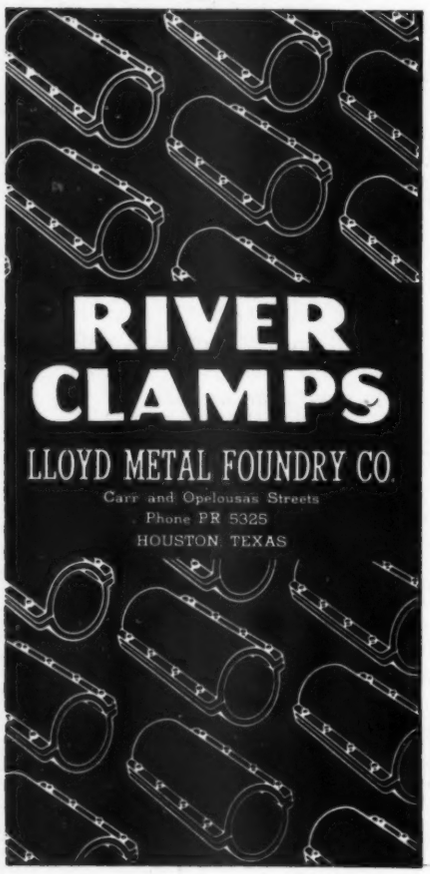
Region 7, W. E. Church, Shell Oil Company, Los Angeles, California.

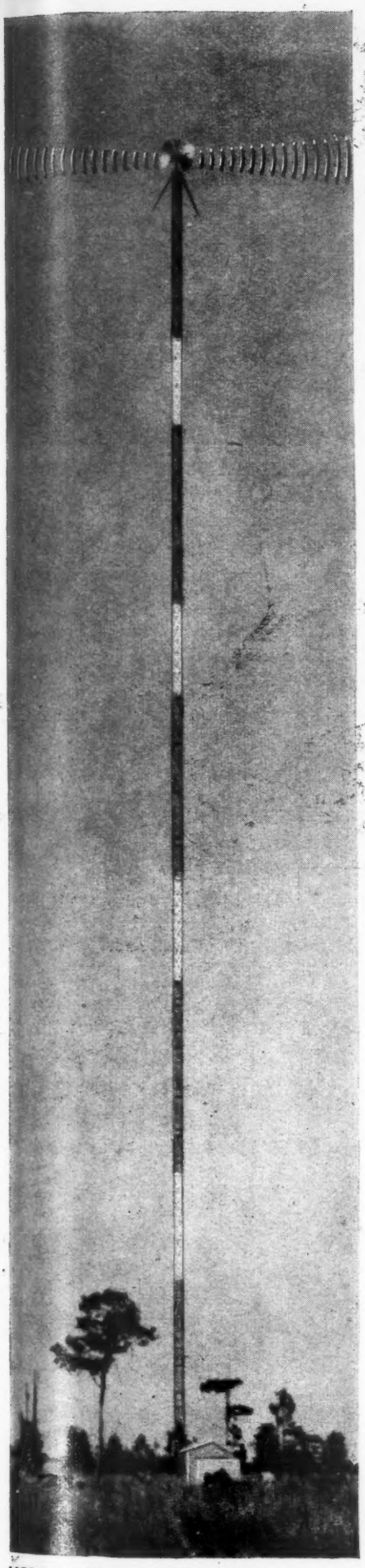
Pipe Line Service Expands Facilities

A new coating and wrapping mill, designed specifically to handle pipe sizes up to 30 in. in diam and 60 ft in length, has been completed at the main plant of Pipe Line Service Corporation in Franklin Park, Illinois, according to an announcement by A. J. Duaei, president.

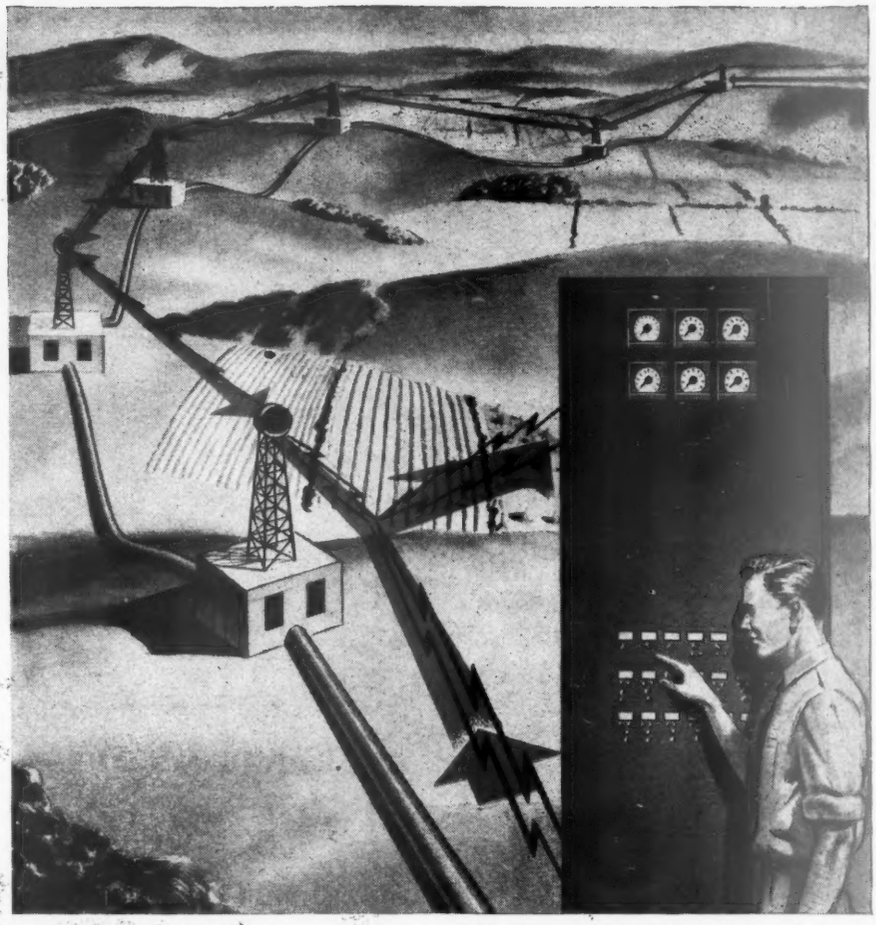
This new mill provides the latest facilities for protecting pipe, incorporating all the important advancements in pipe protection that PLS has perfected during its 20 years in the business, Duaei states. These facilities include such features as large ovens for drying pipe, grit cleaning machines, thermostatically-controlled melting kettles, and other special equipment designed by their engineers and built in the company's machine shop at Franklin Park. The plant layout, coupled with the newest type equipment, expedites the flow of pipe through the complete protective processes.

The Franklin Park plant, with the completion of this new addition, now consists of two pipe coating mills and a modern machine shop on 21 acres, with ample space for the storage and handling of customers' pipe. Three switch tracks serve the two mills, providing direct rail connections to the CMSTP&P Railroad. A "Coating and Wrapping In-Transit" privilege permits pipe to be stopped off at Franklin Park for processing and re-shipment on through rates.





LIGHT-WEIGHT G-E ANTENNAS, top, reduce cost of supporting towers.



UNATTENDED STATIONS are controlled by microwave from dispatcher's office. Motors are switched, valves adjusted, station information relayed.

Microwave remote control holds pumping costs down

G-E engineering co-ordinates complete system to improve station operation, boost throughput

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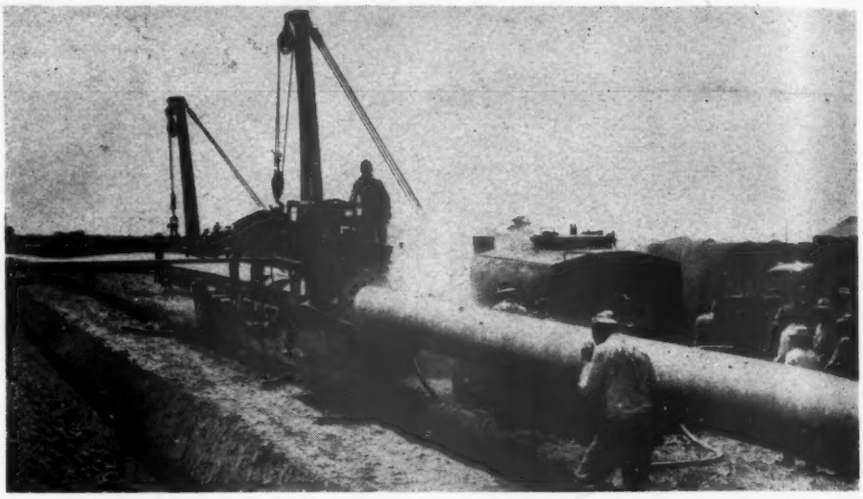
Find out how G-E application engineers use a combination of G-E microwave and supervisory equipment to design remote-control systems that cost less per communication-mile. Contact your G-E Apparatus sales office or write for Bulletin GEA-5745. General Electric Co., Section 661-36, Schenectady 5, N. Y.

Engineered Electric Systems for Oil Pipelines

GENERAL ELECTRIC

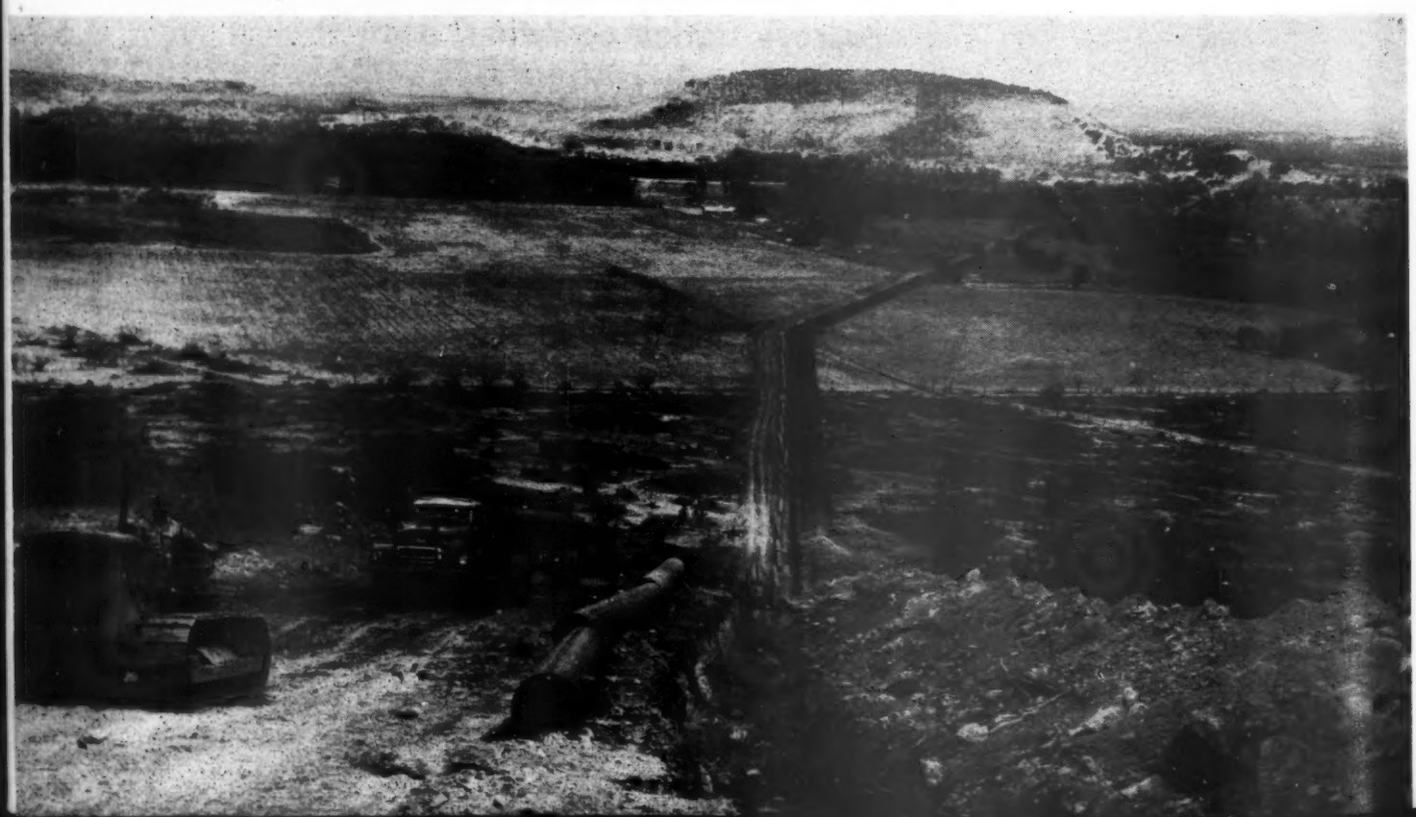
Above, representatives of H. C. Price Company's Somastic division discuss coating operations required to prepare pipe for Transcontinental's Narrows Crossing.

Top right, Caterpillar Diesel D7 tractor pulls a Buckeye ditcher on 30-in. line being constructed in Texas for United Gas Pipe Line Company. Contractor is Oklahoma Pipe Line Constructors.



Coating and wrapping 24-in. pipe near South Houston, Texas, on Rancho Pipe Line Company system. This 455--mile line is being laid from McCamey, Texas, to the Houston-Texas City area. Oklahoma Pipe Line Constructors, contractor.

Stringing truck gets an assist from tractor on steep hill near Ranger, Texas, on West Texas Gulf Pipe Line Company system. J. O. Willett, stringing contractor, Associated Pipe Line Contractors, prime contractor.



PICTORIAL

Right, Raymond Crowe, chief engineer of Transcontinental Gas Pipe Line Corporation, signals arrival of pipe line in Brooklyn as final link in 6600-ft Narrows Crossing is pulled ashore.

Below, A 25,000-gal Watersphere built at Cushing, Oklahoma by Chicago Bridge and Iron Company for Shell Pipe Line Corporation on its Ozark System.

Upper right, Headquarters for Motorola's new West Coast parts and service department, at 811 South B Street, San Mateo, California.

Right, suspension bridge near the Leduc-Woodbend field, Alberta, Canada, on Imperial Oil Pipe Line Company's system. Imperial transports Leduc-Woodbend production, which is 38-39-deg API gravity crude oil, to Nisku, 9 miles from the field. Some of this oil goes to Imperial's Edmonton refinery, the remainder enters the Interprovincial Pipe Line for a 1130-mile journey to Superior, Wisconsin, on the Great Lakes.

Pipe Line Personals

Amedeo Giallorenzi of Baton Rouge, Louisiana, has been appointed assistant director of the Supply and Transportation Division of the Petroleum Administration for Defense, succeeding Perry A. Peterson, who has resigned to return to private industry, Secretary of the Interior Oscar L. Chapman announces.

Secretary Chapman also announced the resignation of **Robert A. Hunter,** who joined PAD's staff last July as assistant director of the Supply and Transportation Division. Hunter has returned to the Gulf Oil Corporation, Pittsburgh, Pennsylvania, where he becomes assistant to the vice president in charge of domestic marketing.

Giallorenzi, a native of New York City, is a graduate of New York University. He has worked for the Standard Oil Company (New Jersey), and its affiliates since 1935. In the latter year he became a tanker expediter for the Standard Shipping Company at Bayonne, New Jersey. He transferred the following year to the New York office of the marine department of the Standard Oil Company (New Jersey), where he held a number of different posts over the next 10 years. In 1945 he was appointed branch manager of the inland waterways department of Esso Standard Oil Company at Pittsburgh, and in February, 1952, he was named operations assistant in the western rivers branch of the same department at Baton Rouge.

J. E. Tom Norris, who has been a junior engineer with the Cities Service Pipe Line Company, has received a permanent assignment to the engineering department.

C. E. Wilson, manager of Service Pipe Line Company's West Texas division, announces the promotion of three employees and the transfer of another to Lubbock, from the company's general offices in Tulsa, Oklahoma.

Promoted were **John J. Wright, Jr.,** to area engineer; **Murray C. McNichol,** to oil traffic engineer, and **Russell L. Reasoner** to division gager with headquarters at Denver City.

Wright, an employee since 1947, has been oil traffic engineer. He was graduated from Weatherford, Texas, high school, and received a degree in mechanical engineering at Texas A. and M. college in 1947.

McNichol was promoted from engineer for the Slaughter district. An employee of the company since 1943, he received a degree in petroleum engineering at the University of Oklahoma in 1948 while on leave of absence from the company to continue schooling.

Reasoner, who joined the company in 1933, had worked at company installations in Oklahoma and other parts of Texas before being transferred to the Slaughter district of the West Texas division. He was a district gager before his promotion.

Frank V. Doucette has been made assistant to **Arthur F. Bridge,** president of Southern Counties Gas Company, Los Angeles, California. He fills a position held for many years by **Joseph Sodoma,** who retired July 1.

Homer Stephens, former division machinist for Service Pipe Line Company at Carrollton, Missouri, has been transferred to Topeka, Kansas, and promoted to area master mechanic for the company's Nebraska division, **C. M. Scott,** general manager, announced in Tulsa.

H. R. Puckett was transferred from Topeka to Carrollton where he will be area master mechanic for the Missouri division.

Stephens, a native of Kansas, joined the company in 1933 as a machinist, moving to Missouri in 1942.

Puckett, also a native Kansan, has been an employee of Service Pipe Line since 1936. He started as a lineman, advancing to machinist.

Earl F. Evans has been appointed safety engineer for Division 1 by Texas Eastern Transmission Company. His headquarters are in Little Rock, Arkansas. A graduate of Louisiana State University, Evans joined Texas Eastern in February, 1950, as a clerk in the general office accounting department, but was soon transferred to the safety department and promoted to senior clerk, a position he held for a year and a half prior to being made safety engineer.

Corrosion Rectifying Company New Firm

Wayne A. Johnson, formerly a corrosion engineer with The Texas Pipe Line Company and more recently associated with Cathodic Protection Service, has formed his own company, Corrosion Rectifying Company. The new firm specializes in cathodic protection consulting, surveys, design and installation work on buried pipe lines, tank bottoms, off-shore drilling platforms, and municipal piping systems. The company, which has its headquarters at 1506 Zora Street, Houston, Texas, also is prepared to make magnesium anode and rectifier installations, Johnson says.

W. C. Martin was recently made superintendent of Station 245, West Winfield, New York, by Tennessee Gas Transmission Company, and **Rex A. Fluty** superintendent of Station 12, Campbellsville, Kentucky. This is an exchange of assignments for these two men.

J. B. Spaulding, station engineer at Wheeler, Texas, has been promoted to assistant station chief engineer by Shell Pipe Line Corporation.

John W. (Jack) Hawkins, planning engineer in the Tulsa office of Service Pipe Line Company, has been transferred to Lubbock, Texas, as a district engineer in the company's West Texas division.

A native Tulsan, Hawkins was graduated from Central high school in 1943. He joined Service Pipe Line Company in 1948 shortly after receiving a degree in business and engineering administration at Massachusetts Institute of Technology, Cambridge, Massachusetts.

Morgan Wallace, formerly assistant to the vice president of Anderson Brothers Corporation, has joined the Panama-Williams Company as a junior partner. Panama-Williams Company is a new pipe line contracting firm organized at Houston, Texas, by M. E. "Panama" Shiflett and Maurice S. Williams.

Paul C. Shea has been appointed assistant director of the supply and transportation division of the Petroleum Administration for Defense and **William H. Midwinter** special assistant to the director of the distribution and marketing division of the agency.

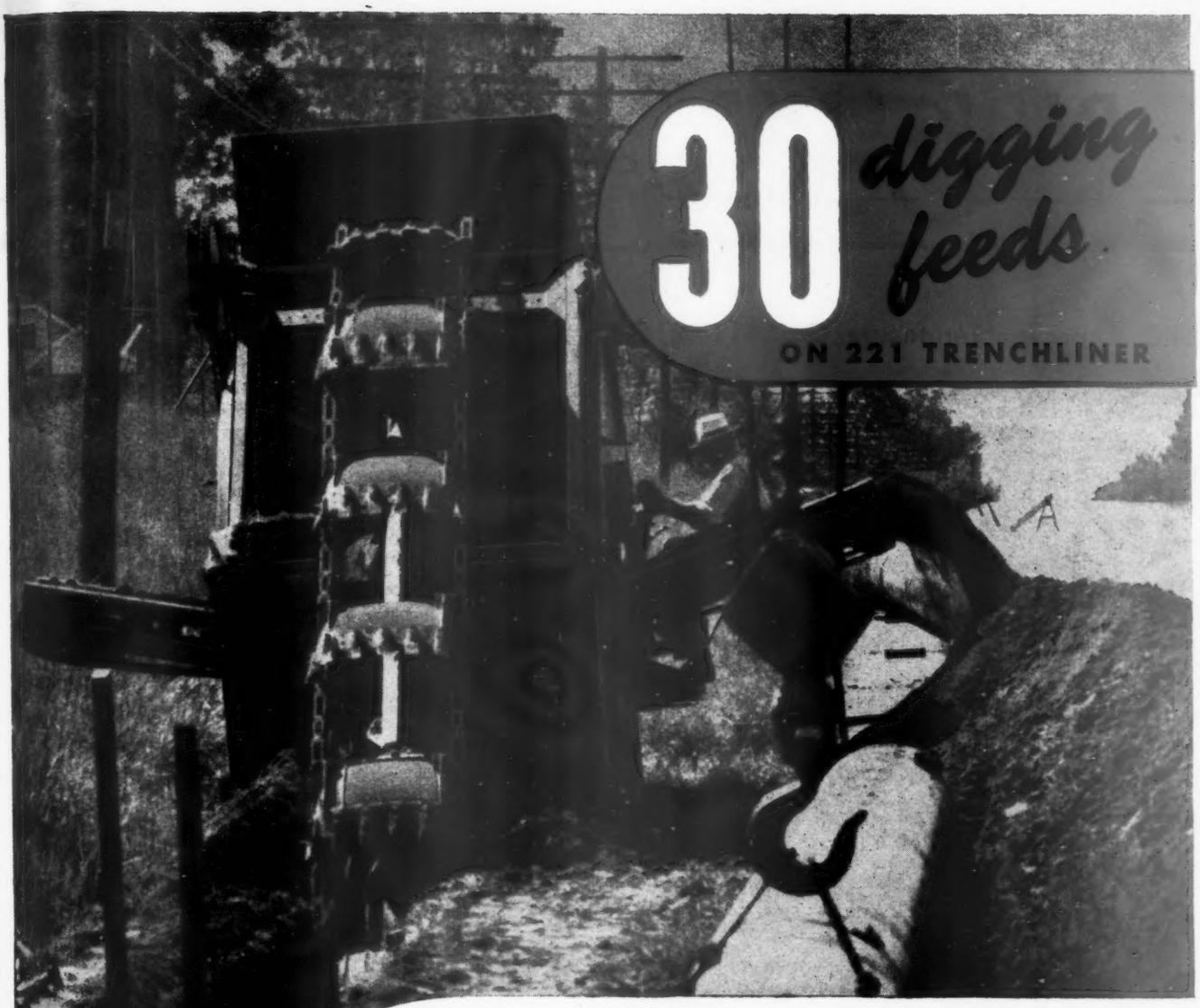
Shea will replace **Robert A. Hunter,** who resigned May 31 to return to the Gulf Oil Company, where he is assistant to the vice president in charge of domestic marketing. Midwinter's position is a new one in PAD.

In 1948 Shea joined the Esso Standard Oil Company, in New York, as assistant to the general manager of the supply and transportation department and subsequently was made manager of the tonnage and tankage division of the supply department. He is on leave from this latter post.

Midwinter has had 34 years' experience in the marketing and distribution phase of the petroleum industry with Socony-Vacuum Oil Company, Inc., where he went to work at 16. He is presently on leave from his post as metropolitan field manager, Asphalt Sales, of Socony-Vacuum, with headquarters in New York.

D. A. Roach, is in charge as chief engineer, of an engineering section that has been organized by Phillips Petroleum Company's supply and transportation department to serve both the products pipe lines and crude oil pipe lines. **E. J. Warren** is assistant chief engineer. **G. P. Jennings,** formerly chief engineer, has been appointed superintendent of operations, products transportation section.

The new engineering section will handle all engineering matters for the pipe line department.



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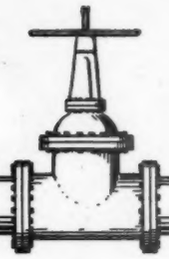
PIPE LINE PROJECTS



FPC Approves Tennessee Gas' $128,216,000 Program

The Federal Power Commission has authorized Tennessee Gas Transmission Company, of Houston, Texas, to carry out a construction program, estimated to cost $128,216,000, that will increase the delivery capacity of its natural gas transmission system by 205,000,000 cu ft a day to a new total of 1,515,000,000 cu ft.

The commission at the same time authorized Tennessee and United Natural Gas Company, of Oil City, Pennsylvania, to jointly develop and utilize an underground storage area for natural gas in the Hebron field in Potter County, Pennsylvania. The storage project, estimated to cost $7,400,000 will provide Tennessee with an additional 200,000,000 cu ft of gas on peak days, or a total system delivery capacity of 1,715,000,000 cu ft.

To provide the 205,000,000 cu ft increase in its transmission system capacity, Tennessee will construct about 591 miles of parallel loop along its existing system; approximately 304 miles of 24-in. line from the Mercer, Pennsylvania, area to a point near Utica, New York, about 137,000 additional hp in existing or authorized compressor stations and 28,000-hp in new stations, and approximately 250 miles of miscellaneous lateral lines.

The project is similar to one for which Tennessee refused to accept an FPC certificate last summer. The commission by orders issued in June and August of 1951 authorized Tennessee to build facilities to increase its system capacity from 1,310,000,000 cu ft to approximately 1,395,000,000 cu ft. Tennessee, however, declined to accept that certificate because the FPC had denied authority for a proposed line from the Hebron field to Utica, New York. The FPC's June, 1951, order also authorized the Hebron storage project, but the certificate lapsed because of Tennessee's failure to accept it in writing within 30 days. In January, 1952, Tennessee filed a petition to reopen the proceedings for the presentation of new evidence, and also asked the FPC to reissue the certificate for the storage project.

El Paso and Allied Projects Authorized

El Paso Natural Gas Company, of El Paso, Texas, has been authorized by the Federal Power Commission to carry out an expansion program, estimated to cost $108,680,164, which will provide additional natural gas to customers in New Mexico, Arizona, and California, and supply a new wholesale customer, which will serve markets in Nevada.

The FPC order authorizes El Paso to construct facilities to provide: (1) An additional 150,000,000 cu ft of gas a day to Pacific Gas and Electric Company, of San Francisco, California; (2) 150,000,000 cu ft additional gas daily to Southern California Gas Company and Southern Counties Gas Company of California, both of Los Angeles; (3) up to 20,000,000 cu ft of gas daily to Nevada Natural Gas Pipe Line Company, of Las Vegas, Nevada, and (4) gas on an interruptible basis to Gallup, New Mexico, for use in a municipally owned electric power generating plant.

The additional volumes will result in total delivery of 550,000,000 cu ft a day to Pacific and 555,000,000 cu ft to the Southern California companies.

The commission at the same time authorized the three California companies and the Nevada company to construct facilities to transport the gas they will receive from El Paso, and authorized San Diego Gas and Electric Company, of San Diego, California, to build a new compressor station.

The FPC also removed the condition, included in a certificate issued to El Paso in July of 1950, limiting the company's deliveries through its San Juan pipe line to not more than 34,000,000,000 cu ft annually. The commission said that since July of 1950, additional gas reserves have been developed in the San Juan Basin, and El Paso has acquired commitments for sufficient reserves from that area to make it reasonable to remove the annual limitation, as well as to authorize the construction of facilities to increase the capacity of its pipe line from the San Juan Basin.

The facilities that El Paso will construct include about 170 miles of main line loop on its existing transmission system, and about 153,000 hp in main line and booster compressor stations.

Pacific Gas and Electric Company will build about 86 miles of loop line and 19,540 additional compressor hp on its existing pipe line extending from a point near Topock, Arizona, to Milpitas, California, to increase its capacity by 150,000,000 cu ft a day. Total cost of Pacific's proposed facilities is $13,428,000.

The two Southern California companies were authorized to construct about 20 miles of loop line and 13,520 additional hp of compressor units on their existing line, which extends from the California-Arizona boundary to Los Angeles. Total cost of these facilities is estimated at $5,053,686.

Nevada Natural's project includes 114 miles of pipe line, extending from a connection with El Paso's system at Topock, Arizona, to the Las Vegas area. The project, estimated to cost $2,319,140, will be used to transport gas for resale, and for sale to industrial customers, in the Las Vegas and Henderson areas.

The San Diego Company's newly authorized compressor station, to be built at Rainbow, California, will provide 10,000,000 cu ft of storage capacity on the company's Rainbow-to-San Diego pipe line. Estimated cost of the station is $499,761.

The commission's order approves a stipulation between El Paso and the Atomic Energy Commission, reserving to the AEC, in marketable quantities, for the period ending June 30, 1957, a total of 150,000,000,000 cu ft of natural gas in the San Juan Basin.

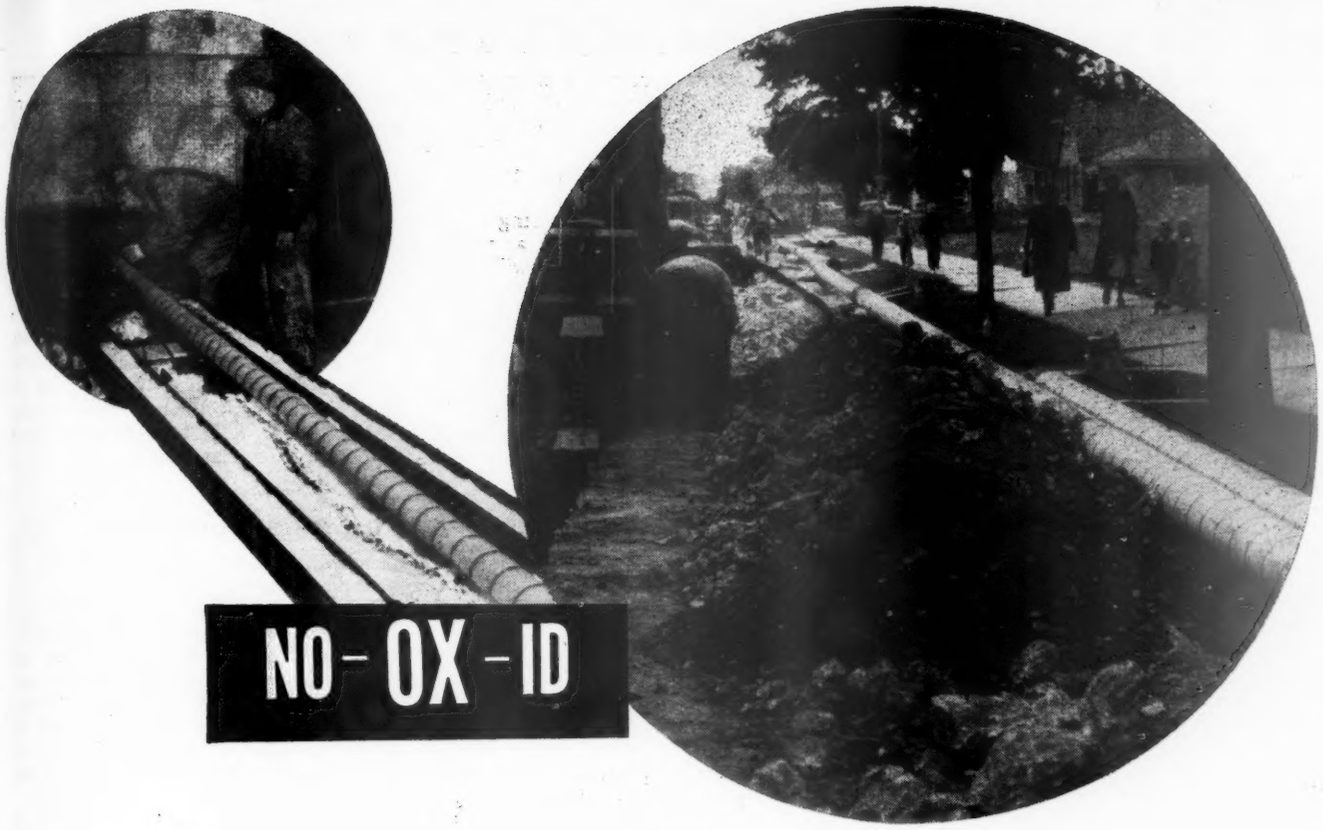
Colorado Request Is Granted in Part

A Federal Power Commission examiner has filed a decision, subject to commission review, that denies in part and grants in part an application by Colorado Interstate Gas Company, of Colorado Springs, Colorado, to construct pipe line facilities to supply natural gas in several Colorado communities.

The examiner also would dismiss an application by Kansas-Colorado Utilities, Inc., of Lamar, Colorado, for authority for a short-term sale of surplus gas to Colorado Interstate, and for the sale of the total production of two gas wells in Stevens County, Kansas, to Panhandle Eastern Pipe Line Company, of Kansas City, Missouri.

The decision, filed by Examiner Francis L. Hall, would authorize Colorado Interstate to construct facilities to serve Pikes Peak Natural Gas Company for resale in the town of Eads and vicinity, and to increase the supply of gas to Citizens Utilities Company, a resale customer, in and near the towns of Fowler and Ordway.

Examiner Hall, however, would deny without prejudice Colorado Interstate's proposals to supply gas to Loran L. Laughlin for resale in Castle Rock and Fountain, and to Kansas-Colorado Utilities, Inc., at points near Springfield and McClave. The examiner found that Colorado Interstate does not now have an adequate supply of gas to serve these two customers.



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Shenandoah Files an Amended Application

Shenandoah Gas Company, of Lynchburg, Virginia, has filed an amended application with the Federal Power Commission in connection with its proposal to construct a natural gas transmission line to supply markets in northern Virginia and northeastern West Virginia. Shenandoah is also seeking an order from the commission directing Virginia Gas Transmission Corporation to supply the natural gas requirements for its proposed project.

Under its revised plan, Shenandoah would build a 39-mile pipe line extending from a point on Virginia Gas Transmission Corporation's system near Middletown, Virginia, to points near Winchester, Virginia, and Martinsburg, West Virginia. The company also proposes to construct distribution systems in Winchester and in small communities along the route of the proposed line in Virginia and West Virginia. Estimated cost of the project is $1,570,000. Shenandoah's system would have a delivery capacity of 14,000,000 cu ft of gas a day.

Shenandoah's original application was filed with the FPC in July, 1950. The company then proposed to build 49 miles of pipe line, extending from a point on Virginia Gas' line near Cedarville, Virginia, to the communities proposed to be served, including Front Royal and Winchester, Virginia, and Martinsburg, West Virginia. Estimated cost of the project as originally proposed was $2,300,000.

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Service Plans Trunk Line From Williston Basin

A trunk line to provide a necessary pipe outlet from oil fields of the Williston Basin in North Dakota will be built in 1953 or 1954 by Service Pipe Line Company, J. L. Burke, president, has announced.

The line would tie in to gathering systems in the Beaver Lodge field, as well as newly discovered fields, and will include service to a new refinery in the Mandan-Bismarck area to be built by Standard Oil Company (Indiana).

Present plans call for the steel pipe line to be 12 in. in diam with an initial capacity of 15,000 bbl daily. The original facilities would include one pump station.

J. L. Burke said the line's capacity could be expanded by installation of additional pumping equipment.

Burke said a route for the line and location of the pump station will be influenced by future development of North Dakota Williston Basin fields. Present estimates indicate the line will extend about 170 miles from near Tioga.

Williston Basin's first crude oil pipe line was built by Service in North Dakota last winter. This line, originally a 14-mile gathering system now expanded to approximately 20 miles of pipe, connects producing wells in the Beaver Lodge field to a railroad tank car loading rack at Tioga.

Texas Eastern Allowed to Make Station Changes

The Federal Power Commission has approved certain compressor station changes, already partly carried out, by Texas Eastern Transmission Corporation, of Shreveport, Louisiana, on a project authorized by the FPC February 27, 1951, to expand the capacity of the company's natural gas transmission system.

The changes permit Texas Eastern to construct 12 compressor stations with a total of 102,540 installed hp in lieu of the 13 stations with an aggregate of 96,400 hp as previously authorized. No increase in transmission capacity over that previously authorized results from the modification. The 12 station sites are along Texas Eastern's system in Mississippi, Alabama, Tennessee, Kentucky, Ohio, Pennsylvania, and New Jersey.

In authorizing the changes, the commission noted that Texas Eastern conceded it was "tardy" with its request for modification of the February, 1951, order. The FPC said that Texas Eastern had departed markedly from the authorized compressor facilities as to location, spacing design, amount of horsepower, and type of station.

Texas Eastern blamed its failure to proceed with the project as authorized on a lack of proper coordination between its top engineering personnel and company department handling FPC matters. FPC said that while there could be no doubt there was a violation of its order, it was persuaded that Texas Eastern's actions were not willfully done.

Total cost of the compressor facilities as originally authorized was estimated in December, 1950, at $18,805,200, but this estimate has been increased to $22,060,000 at the present time. The estimate under the revised design is for a total of $20,062,500.

The compressor facilities are part of a project to increase the capacity of Texas Eastern's system by about 465,700,000 cu ft a day, to a total of approximately 1,206,500,000 cu ft. The project, now nearing completion, also includes a 791-mile line extending from a point near Kosciusko, Mississippi, to the Connellsville, Pennsylvania, area.

Gas Line Approved in Long Range Planning

Another first was scored by Southern Counties Gas Company when the Petroleum Administration for Defense approved installation of 17,000 ft of 16-in. pipe line south from San Luis Obispo toward Arroyo Grande in the company's northern division.

Initially, this 17,000-ft section will be used for the sole purpose of providing an additional million cubic feet of much needed gas storage for the city of San Luis Obispo.

Some years later, as the need develops, the section will become a part of a 16-in. gas transmission pipe line paralleling the present 8-in. line from San Luis Obispo to Arroyo Grande.

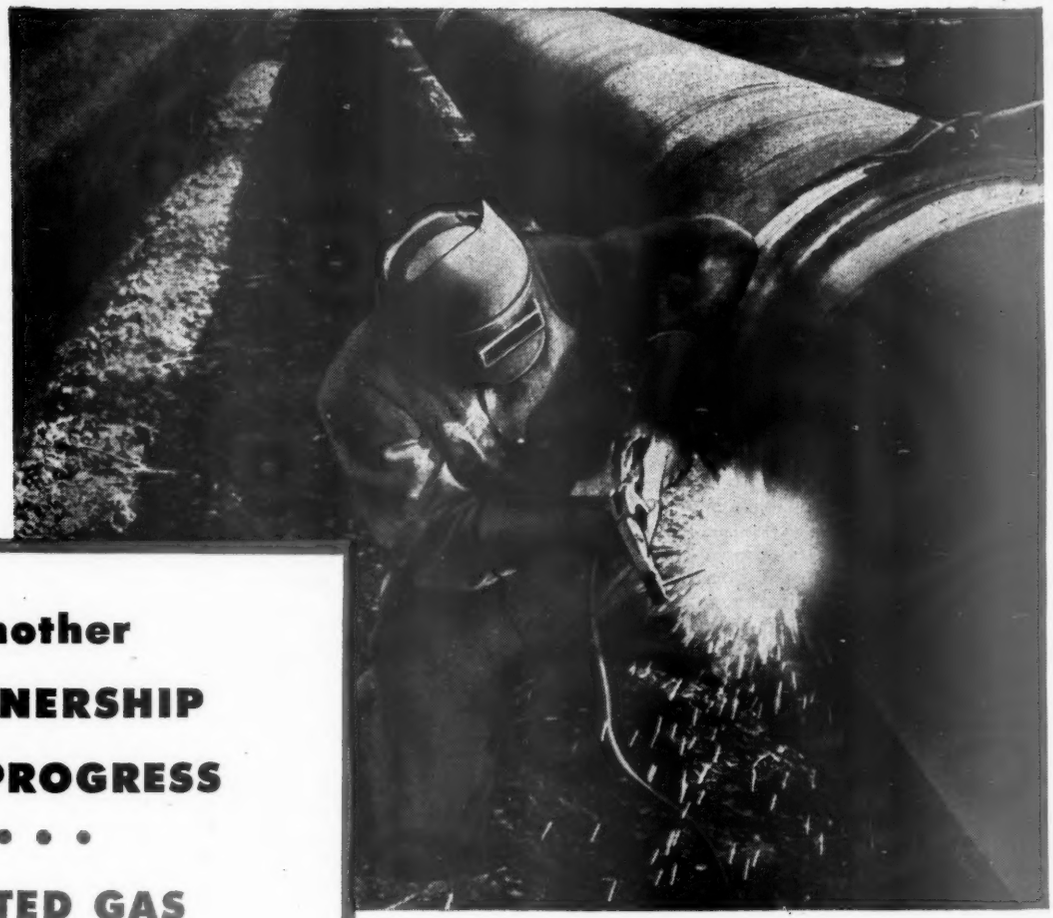
This is the first time in the history of the gas industry, according to the information at hand, that any such long-range pipe line construction program has been planned with the idea of first supplying presently needed gas storage and later providing the additional transmission facilities that growth studies show will be needed.

Based on the indicated growth of the area, future plans call for the installation of a second 17,000 ft of line extending farther south in 1955. This will provide another million cubic of storage capacity.

Then in 1958, according to present plans, the line will be completed to Arroyo Grande. There it will connect with the line south, and it will thereafter be used as a high pressure transmission pipe line. At that time it will also provide approximately 3,900,000 cu ft of line pack storage.

In its approval PAD also included a 165-hp compressor unit to be installed at San Luis Obispo. This unit will be used to compress gas to 850 psi to pack the line for storage during off-peak hours. It will be designed with an integral shelter unit and will require no separate building to house it. When the line is finally completed, the compressor unit will be moved from San Luis Obispo to Arroyo Grande.

Construction will begin as soon as pipe becomes available, which probably will be sometime in the fall.



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Compressor Station Proposed By Arkansas Louisiana Gas

Arkansas Louisiana Gas Company, Shreveport, Louisiana, has applied to the Federal Power Commission for authority to construct 6 miles of 12¾-in. natural gas pipe line and a 7500-hp compressor station in Arkansas.

The 6 miles of line, in Hot Spring County, would be used to make available an additional 38,000,000 cu ft of natural gas a day to the Lake Catherine steam electric generating station of Arkansas Power and Light Company.

The proposed compressor station would make available substantially greater volumes of gas to consumers in Central Arkansas, the application states. The station would be connected to the company's "Line S", which extends from Waskom, Texas, to Perla, Arkansas. The application says that installation of the proposed compressor station would increase average daily deliveries to the Perla regulating station next winter by about 25,000,000 cu ft a day.

Total estimated cost of the proposed construction is $2,353,116, consisting of $205,646 for the proposed 6-mile line, and $2,147,470 for the compressor station.

Southern Natural Proposes Louisiana Station

Southern Natural Gas Company, of Birmingham, Alabama, has filed an application with the Federal Power Commission in connection with the proposed construction of a 3300-hp compressor station in the Logansport gas field, in Louisiana.

The proposed new compressor station, estimated to cost $1,021,500, is required because of declining wellhead pressures of wells in the Logansport field, the application states. The station would be on Southern's 14-in. Logansport supply line, which extends from the Logansport field to the company's Perryville compressor station in Ouachita Parish, Louisiana. Southern said that the station would permit delivery through the Logansport line of the volumes needed to supply requirements from the field during the winter of 1952-53.

Would Convert Producing Pools to Storage Service

The Ohio Fuel Gas Company, of Columbus, Ohio, has applied to the Federal Power Commission for authority to expand its underground natural gas storage facilities by converting six producing pools to storage service in north central Ohio.

Total estimated capital cost of the proposed construction is $4,880,000 to be financed with funds provided by Ohio Fuel's parent, The Columbia Gas System, Inc. Ohio Fuel said the project would help to enable it to accept gas available to it from outside sources during summer months to assist in serving increased requirements during winter.

The proposed project includes a 6000-hp storage compressor station; 78.2 miles of well and gathering lines; 14.2 miles of pipe line to connect the storage areas with existing transmission facilities, and auxiliary equipment, meters, valves, and other incidental facilities.

Ohio Fuel proposes to convert one pool in Ashland and Richland counties, to become a part of the Weaver storage area; to develop a new storage area in Holmes, Wayne, and Ashland counties by converting four pools, and to develop a new storage area in Guernsey and Coshocton counties by converting one pool.

The application says that the potential storage capacity of the six pools is estimated at 31,100,000,000 cu ft of natural gas, which would bring the total capacity of the company's storage areas to 143,350,000,000 cu ft.

Arkansas-Missouri Gas Line Approved by FPC

Arkansas-Missouri Power Company, of Blytheville, Arkansas, has been authorized by the Federal Power Commission to construct approximately 140 miles of pipe line to provide natural gas service to 13 communities in Arkansas and 5 in Missouri.

The company will construct natural gas transmission lines extending from two separate points of connection with the system of Texas Eastern Transmission Corporation, of Shreveport, Louisiana. The 140 miles of pipe, ranging in size from 2⅜ in to 10¾ in. will connect with Texas Eastern at points just west of the St. Francis River in Clay County, Arkansas, and near Campbell, Missouri.

Estimated overall capital cost of the proposed facilities is approximately $4,000,000. Texas Eastern will deliver up to 6,308,000 cu ft of gas a day to Arkansas-Missouri.

Application Made for Line in New York State

New York State Electric and Gas Corporation, of Ithaca, New York, has filed two applications with the Federal Power Commission proposing the construction of a total of about 59 miles of natural gas transmission line and an additional 2200-hp at an existing compressor station, all in New York state.

Total estimated cost of the new facilities proposed in the two applications is $2,382,286.

In its first application (Docket No. G-1999), the company is seeking authorization to construct 49 miles of pipe line, consisting of approximately 25 miles of 10-in. pipe and 24 miles of 8-in. pipe. The 10-in. line would extend from a connection with the system of New York State Natural Gas Corporation, its supplier, in DeRuyter, New York, to New York State Electric's existing distribution system in Norwich, New York.

The second application (Docket No. G-2000) proposes the installation of an additional 2200-hp at the company's Auburn, New York, compressor station, and the construction of 9.5 miles of 10-in. line paralleling its line from Auburn to Seneca Falls.

United Natural Gas Construction Authorized

United Natural Gas Company, of Oil City, Pennsylvania, has been authorized by the Federal Power Commission to construct pipe line facilities that will increase the delivery capacity of its natural gas transmission system in Pennsylvania.

New facilities, estimated to cost $798,500, will increase the flexibility of the system and increase its capacity.

The construction program includes: (1) About 15.1 miles of 12-in. pipe from United's Van compressor station extending around the western boundary of Oil City to a connection with the existing Oil City-Titusville line, replacing in part an existing line; (2) approximately 14,175 ft of 6-in. line, replacing an existing 3-in. line north of Tidioute, Pennsylvania, and a continuation of this line with a new 6-in. line, about 51,310 ft long, extending northeasterly to a connection with United's existing Youngsville-Irvine line, permitting the removal of 26,834 ft of line between Tidioute and Pittsfield, and (3) about 0.38 miles of 12-in. pipe as an emergency bypass around the Van compressor station.

FPC Authorizes Gas Line in California

Construction of 50 miles of pipe line by Pacific Gas and Electric Company, of San Francisco, California, to increase natural gas deliveries to the Fresno-Merced service area in California, has been authorized by the Federal Power Commission.

New facilities, estimated to cost $1,979,000, will reinforce Pacific's system interconnecting the Fresno-Merced area, which consists of a number of towns in Fresno, Madera, and Merced counties. The facilities will permit the taking of additional gas into the system and will facilitate the delivery of the gas throughout the system.

The construction program includes 20 miles of 16-in. line in Fresno County, extending from Burrel to a point near Easton; 15 miles of 20-in. pipe, also in Fresno County, from Holm to the company's Topock-Milpitas line and paralleling a portion of an existing line, and 15.5 miles of 12¾-in. pipe paralleling the existing Madera-Livingston line in Madera County.

To Build Compressor Station in South Dakota

The Federal Power Commission has authorized Montana-Dakota Utilities Company of Minneapolis, Minnesota, to construct a 2640-hp compressor station in Butte County, South Dakota, to provide more natural gas for consumption in the Black Hills area of South Dakota.

Present facilities used by the company to supply the Rapid City-Sturgis area are estimated to be capable of delivering about 23,000,000 cu ft of gas a day, and the addition of the new station is expected to enable Montana-Dakota to meet its estimated 1956-1957 peak-day requirements of 31,220,000 cu ft.

Hearing in August on Canada Export Proposal

The Federal Power Commission has scheduled a hearing to begin August 6 in Washington, D. C., on applications by Tennessee Gas Transmission Company, of Houston, Texas, and Niagara Gas Transmission, Ltd., of Toronto, Canada, which are seeking authority to export natural gas from the United States for ultimate consumption in eastern Ontario, Canada.

Tennessee and Niagara proposals previously were consolidated for hearing with several other applications involving the import and export of natural gas from and to Canada; however, the commission on July 1 severed the Tennessee and Niagara proposals because they were not related to the other applications, which involve plans to import gas from Canada to serve markets in the Pacific Northwest and Midwest.

Tennessee and Niagara jointly are seeking authority to export about 24 billion cu ft of gas a year from the United States to Canada. Under the proposal, Tennessee would transport the gas from the Gulf Coast area for delivery to Niagara at the U. S.-Canadian boundary near Niagara Falls, New York, for resale in Toronto and other eastern Ontario markets.

Tennessee also is seeking a certificate for the construction and operation of additional facilities to transport the gas for Niagara, and a Presidential Permit to construct, maintain, and operate facilities at the International Boundary. The certificate application covers proposed facilities, estimated to cost $44,740,000, which would increase the daily design delivery capacity of Tennessee's system from the total of 1,515,000,000 cu ft as presently authorized or applied for, to approximately 1,581,000,000 cu ft.

Northern Permitted to Construct New Facilities

The Federal Power Commission has authorized Northern Natural Gas Company, of Omaha, Nebraska, to construct new pipe line facilities designed to increase the delivery capacity of the company's natural gas transmission system north of Kansas from the presently authorized 600,000,000 cu ft a day to a new total of 825,000,000 cu ft.

The project will supply additional gas to Northern's currently connected utility customers for resale to attached consumers and for commencing service to prospective consumers in communities now being served. Northern sells natural gas for resale in Oklahoma, Kansas, Nebraska, Iowa, Minnesota, and South Dakota.

The facilities that Northern was authorized to construct, to be located in Texas, Oklahoma, Iowa, Kansas, Nebraska, and Minnesota, include a total of 213 miles of 26-in. loops, and an additional 100,160 hp in compressor capacity. Estimated cost of these facilities is $38,690,000.

In addition, Northern proposes to build certain other facilities, which it contends do not require FPC authorization, including gathering system, production plant, pipe line, and compressor station and gasoline plant additions, estimated to cost $29,360,200.

The commission, however, found that Northern had erroneously classified part of these facilities, having an estimated cost of about $7,250,000 as "gathering facilities", and required the company to file an application with the FPC within 30 days for their construction and operation.

Northern also contended that another portion of these additional facilities, estimated to cost about $3,750,000, are exempt because they do not affect system capacity. In this instance, the commission found that the facilities apparently will require an FPC certificate, and directed Northern to file within 30 days an application requesting appropriate authorization, or establishing that a certificate is not required.

Acquisition Mississippi Gas Properties Sought

Mississippi Valley Gas Company, of Jackson, Mississippi, has applied to the Federal Power Commission for authority to acquire and operate certain natural gas transmission facilities in Mississippi, from Mississippi Gas Company, of Meridian.

Facilities involved in the proposed transaction include Mississippi Gas' pipe line system in Clay, Monroe, Chickasaw, and Lee counties; related storage facilities in Monroe County, and a pipe line system operated by Mississippi Gas in Winston, Choctaw, Webster, Calhoun, Oktibbeha, and Chickasaw counties, under lease from North Central Natural Gas District.

The purchase price, based on Mississippi Gas' balance sheets as of March 31, 1952, would be $3,300,000, subject to closing adjustments.

Although Mississippi Valley proposes to acquire all Mississippi Gas Company properties, the application asks authorization for the acquisition either by purchase or lease, to the extent that the commission has jurisdiction over the facilities and their operation. Mississippi Gas, a subsidiary of Southern Natural Gas Company, joined in the application for approval to abandon the facilities, to the extent that FPC has jurisdiction.

A 2640-hp Compressor Station Asked for Wyoming

Mountain Fuel Supply Company, of Salt Lake City, Utah, has asked the Federal Power Commission to authorize the construction and operation of a 2640-hp compressor station on the company's natural gas transmission system in Uinta County, Wyoming.

Proposed project, estimated to cost $772,000, would make up the deficit in supply required to serve the peak load heating requirements of firm customers in an area now served by the company.

The company said that its present deliverability to Utah is 165,000,000 cu ft of gas a day, and that the proposed compressor station would increase this to 177,000,000 cu ft.

Colorado-Wyoming Decision Effective

A decision by a Federal Power Commission Presiding Examiner authorizing Colorado-Wyoming Gas Company of Denver, Colorado, to construct natural gas pipe line facilities on its system in Colorado and Wyoming, has become effective as the final decision and order of the FPC.

The decision, filed by Examiner Ewing G. Simpson, was issued on May 26. Since no exceptions were filed or review initiated by the commission, the decision became effective as of June 26 in conformity with the FPC's rules.

Among other things, the decision authorizes Colorado-Wyoming to serve the Atomic Energy Commissions plant now under construction at Rocky Flats, Colorado. In addition, the company will build a lateral line and meter station to supply natural gas at wholesale to Milliken, Colorado; install about 8000 ft of 8-in. supply line to augment service to the Fort Warren-Cheyenne, Wyoming, area; and replace 2 miles of 4-in. pipe with 8-in. pipe on its Golden, Colorado, lateral. Estimated cost of the construction is $149,904.

New York Natural Plans 95 Miles of Pipe Lines

The Federal Power Commission has been asked to authorize the construction of approximately 95 miles of natural gas transmission lines in Pennsylvania by New York State Natural Gas Corporation, of New York City.

The proposed construction program includes 20 miles of 16-in. pipe line, extending southwest from a connection with an existing line in Clinton County, Pennsylvania, to a point near the recently discovered Driftwood gas field in Cameron County, Pennsylvania. From the southern end of this line, the company plans to build 75 miles of 20-in. line extending to a connection with its main dual line transmission system in Armstrong County, Pennsylvania.

In addition, New York State Natural would build 970 ft of 20-in. line in Tioga County, Pennsylvania, connecting its Sabinsville compressor station with existing transmission lines. This will permit the compressor station to be used to relay main line gas as well as for its primary purpose in the operation of the Sabinsville storage pool.

The company said it would not build the 75-mile line until 1953, but that the other construction would be carried out as soon as FPC authorization is obtained. Total estimated cost of the construction program is $5,332,506.

The application says that the initial purpose of the 20-mile line is to permit the company to gather and take into its general system gas that is now available and other gas that will become available soon in the Driftwood field. The permanent purpose of the line, the application says, is to provide a link in the looping of the company's principal transmission system between its Tonkin compressor station in Westmoreland County and its Sabinsville station in Tioga County.

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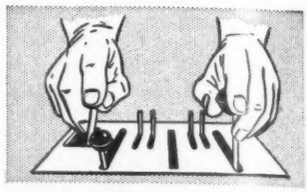

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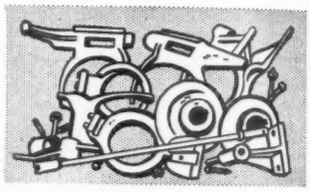

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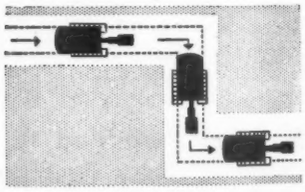

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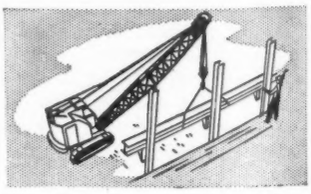

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With the PIPE LINE CONTRACTORS

Associated Pipe Line Contractors, Inc., 3272 Westheimer Road, Houston, Texas, who contracted 201 miles of 3-in. through 16-in. on the Algonquin Gas Transmission Corporation system in Connecticut, Massachusetts, and Rhode Island, has sub-contracted 100 miles of the job to Fulghum Construction Company. Associated's field office is at Milford, Massachusetts, where L. H. Gray is superintendent and Jack Bradley office manager.

Trojan Construction Company, Inc., 1416½ North Robinson, Oklahoma City, Oklahoma, is taking up 350 miles of 10 and 12-in. pipe in Indiana and Ohio for Ohio Oil Company. A part of the pipe will be reconditioned. This work was sub-contracted from Conyes Construction Corporation. Charles T. "Swede" Tillotson is general superintendent. One spread is working out of Elwood, Indiana, where Maurice Crawford is spreadman and Don Wilson office manager. The second spread has its field office at Spencerville, Ohio. "Slim" Devers is spreadman and Phil Whitaker office manager.

Mannix, Ltd., Calgary, Alberta, Canada, has in progress 224 miles of 24-in. pipe line construction for Trans-Mountain Oil Pipe Line Company, from the Blue River to Coquihalla Pass, British Columbia. The field office is at 412 Victoria Street, Kamloops, British Columbia. C. P. Baker is project manager, Jimmy Allman spread superintendent, and H. Eisler office manager.

Houston Contracting Company, 2707 Ferndale Place, Houston, Texas, has the following construction work under contract:

Approximately 126 miles of 30-in. natural gas line for Tennessee Gas Transmission Company at three different locations in Arkansas, Louisiana, and East Texas as follows:

43 miles of 30-in. from the west side of the Mississippi River south to the vicinity of Gallion, Louisiana. W. H. Hayes, superintendent; M. L. Thompson, assistant superintendent; J. C. Strickler, field office manager; headquarters, Eudora, Arkansas. Expect to complete job about July 25.

45 miles of 30-in. from the vicinity of Eros, Louisiana, south to vicinity of Coldwater, Louisiana. F. A. Silar, superintendent; L. F. Redfearn, field office manager; headquarters, Jonesboro, Louisiana. Started laying pipe July 15.

39 miles of 30-in. from a point west of the Sabine River south to Jasper compressor station. E. C. Norris, superintendent; R. E. Thornton, assistant superintendent; R. J. Axsom, field office manager; headquarters, Jasper, Texas. Expect to complete job about July 25.

Approximately 190 miles of 24-in. crude oil line for Rancho Pipe Line Company from a point west of Austin, Texas, to Shell Oil Company's Deer Park Refinery near Pasadena, Texas.

Oklahoma Pipe Line Constructors has completed approximately 47 miles of their 64-mile section from Deer Park west to the Brazos River. Houston Contracting Company is working on the Brazos and Colorado River crossings. Further work has been delayed due to lack of pipe.

Approximately 20 miles of 18-in. natural gas line reconditioning for Texas Gas Transmission Corporation in two sections, one south of Memphis, Tennessee, and one near Wilmot, Arkansas. J. A. Cantrell, superintendent; J. B. Stoddard and C. V. Oliver, field office managers; headquarters, Memphis, Tennessee. Work just starting on 9-mile section near Memphis, Tennessee.

Approximately 46 miles of 26-in. natural gas line for Texas Gas Transmission Corporation from Beekman compressor station near Bastrop, Louisiana, north to the Mississippi River. W. H. Hayes, superintendent; M. L. Thompson, assistant superintendent; J. C. Strickler, field office manager; headquarters, Eudora, Arkansas. Starting date indefinite due to delay in receiving pipe.

Approximately 16 miles of 12-in. and 51 miles of 16-in. crude oil lines for Interstate Oil Pipe Line Company. The 12-in. is in the vicinity of Raceland, Louisiana, and the 16-in. is from Sunset, Louisiana, east to the Mississippi River at Anchorage, Louisiana. H. L. Leake, superintendent; S. B. Harrison, assistant superintendent; H. C. MacWhinnie, field office manager; headquarters, Houma, Louisiana. Work to start on the 12-in. section immediately.

This report was made the middle of July.

River Construction Corporation, 6100 Camp Bowie Boulevard, Fort Worth, Texas, is laying an undetermined amount of 30-in. pipe for the United Gas Pipe Line Company. There are four mainline spreads and two river crossing spreads in the field, as follows:

Monroe, Louisiana — Merle Tatom superintendent and Earl Nevins office manager. A river crossing spread is working out of this office with "Banty" Traweek superintendent and Paul Upton handling the office work. The crew is installing crossing of the Ouachita and D'Arbonne rivers.

Natchitoches, Louisiana—H. J. "Red" Tatom superintendent and Lee Price office manager.

Jasper, Texas—Jimmy Reid superintendent and Pat Rogan office manager.

Livingston, Texas — Barney Hall superintendent, "Borger Red" McMenamy assistant, and Lee Green office manager.

St. Augustine, Texas — The spread working out of this office is installing the Sabine River crossing. Charley Simmons is superintendent and Ed Pratt office manager.

Anderson Brothers of Venezuela, C. A., 6300 Navigation Boulevard, Houston, Texas, is making a crossing of the Gulf of Coro in Venezuela for the Creole Petroleum Corporation. The crossing will require approximately 80,000 ft of 26-in. pipe. "Red" Goode is in charge of the work. Field office is at Las Piedras.

H. C. Price Co.—Pipeline Division, P. O. Box 1111, Bartlesville, Oklahoma, has the general contract with Tennessee Gas Transmission Company covering construction of 83 miles of 26-in. high pressure natural gas pipe line in two loops, one covering 23.4 miles near Carrollton, Ohio, and the second 59.52 miles in length near Athens, Ohio. Spreads are as follows:

Nelsonville, Ohio; Box 286; Telephone 1000: G. A. Reutzel, superintendent; W. E. Yount, office manager; Ernest Dickson, office clerk; R. D. Anderson, materialman; Kenneth George, engineer; J. H. Ingram, chief mechanic; K. N. Adkins, road crossing foreman; J. A. Hairston, brush; Lloyd J. Loncarich, ditch; J. C. Anderson, bending; H. C. Morrison, pipe; R. W. Orr, welding; S. J. Wood, coating; Athel Bell, lower-in; T. E. Walker cleanup, and Charles Schooler, warehouseman.

A general contract covers construction of approximately 363 miles of 26-in. high pressure natural gas loop lines for Texas Gas Transmission Corporation from east bank of Mississippi River near Greenville, Mississippi, to Jeffersontown station, Kentucky, a few miles east of Louisville. Start of work awaiting satisfactory authorization from Federal Power Commission. Spread located as follows:

Cleveland, Mississippi; General Delivery; Telephone 833: C. R. Ice, superintendent; G. A. Harvey, office manager; R. J. Immel, office clerk; Fred W. Simmons, timechecker; L. R. Clark, materialman; Paul E. Hawkins, engineer; C .E. Birmingham, chief mechanic; Jesse Cash, brush foreman; E. W. Whisenant, ditch; W. O. Elliott, dozers; Forest Loinette, bending; W. T. Dickerson, pipe; L. O. Reutzel, welding; N. D. Adams, coating; J. C. Rich, lower-in, and J. E. Hamilton, cleanup.

General contract with Brown & Root, Inc., covers construction of 43 miles of 30-in. high pressure natural gas pipe line for the Texas Eastern Transmission Corporation in the vicinity of Wheeling, West Virginia. Spread as follows:

Moundsville, West Virginia; Box 383; Telephone 1898: R. K. Shivel, superintendent; W. R. Crego, office manager; Joe Eakin, office clerk; A. B. Allen, timechecker; R. I. Genet, materialman; R. J. Orr, engineer; Tommy Stammer, chief mechanic; J. D. White, dozer foreman; W. H. Olrich, ditch; Cleo Robertson, ditch; J. H. Latham, bending; Delbert Shivel, pipe; R. L. Ezell, welding; J. B. Northcutt, coating; C. W. Sisco, lower-in. and S. L. Price, cleanup.

Contractors

Williams Brothers Corporation of Canada, Edmonton, Alberta, Canada, is laying 176 miles of 10-in. between Kingston, Ontario, and Montreal, Quebec, and 46 miles of 6-in. from Farrens Point, Ontario, to Ottawa, Ontario, for Trans-Northern Pipe Line Company, a products line. The field office is at Gananoque, Ontario, with "Peewee" Petty superintendent, Claude Lightfoot assistant superintendent, Charlie Simms office manager, and "Dutch" Gill master mechanic.

P. & S. Constructors, Inc., Cape Girardeau, Missouri, is laying 276 miles of 14-in. between Wood River, Illinois, and East Chicago, Indiana, for Shell Oil Company. Field headquarters are at Peotone, Illinois. "Arkie" Hobson is superintendent and V. E. Connor office manager.

Western Pipe Line Constructors, Inc., Lockhart Building, Austin, Texas, has in progress 80 miles of 26 and 30-in. in Tennessee and Kentucky for Tennessee Gas Transmission Company, consisting of 32 miles from White Bluff to Springfield, Tennessee, 27 miles from Greensburg to Lebanon, Kentucky, and 21 miles from Muses Mill to Olive Hill, Kentucky. There are two field offices:

At Dickson, Tennessee, Jack Hodges is superintendent and A. G. Goyne office manager.

At Morehead, Kentucky, Bennie Williams is superintendent and P. O. Rutledge office manager.

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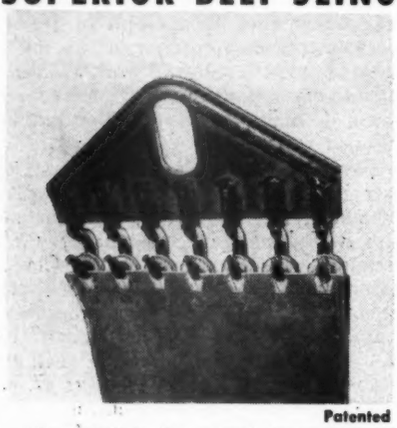

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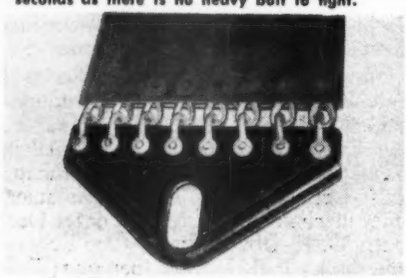

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J. L. Cox and Son, Raytown, Missouri, are just completing the stringing of 280 miles of 20-in. pipe on the Platte Pipe Line Company system, the work being done between West Alton and Kenmoor, Missouri. Between Salisbury, Missouri, and Forest City, Illinois, 175 miles of 22-in. pipe is being strung for Sinclair Pipe Line Company. For the same company, 386 miles of 8-in and 46 miles of 12-in. takeup pipe is being hauled. The line is being taken up between Salisbury and West Alton.

Panama-Williams Company, 403 Melrose Building, Houston, Texas, began work the early part of July on 38 miles of 20-in. between Wortham, Texas, and a point in Henderson County, 38 miles to the east. The field office is at Fairfield. M. E. "Panama" Shiflett is general superintendent, Gene Coulter spreadman, Cooney Shiflett assistant spreadman, Ernest Smith and L. S. Hooks office managers, and J. O. Doggett master mechanic.

Dunn Bros., 801 Mercantile Securities Building, Dallas, Texas, are stringing 80 miles of 30-in. pipe in Tennessee and Kentucky for Tennessee Gas Transmission Company. Western Pipe Line Constructors, Inc., is the prime contractor.

For the Texas Eastern Transmission Corporation, an indefinite mileage of 30-in. is being strung in Ohio and West Virginia. H. C. Price Company is the prime contractor.

In Illinois, Indiana, and Ohio, 320 miles of 10 and 12-in. pipe is being strung for Ohio Oil Company. Conyes Construction Corporation is the prime contractor.

In Ohio, 60 miles of 26-in. pipe is being strung for Tennessee Gas Transmission corporation.

Work continues for El Paso Natural Gas Company in New Mexico and Arizona.

O. R. Burden Construction Corporation, 6702 East 21st Street, Tulsa, Oklahoma, now has two spreads at work on the 175 miles of 22-in. between Salisbury, Missouri, and Forest City, Illinois, for Sinclair Pipe Line Company. One spread has its headquarters at Huntsville, Missouri, where H. E. "Shorty" Doyle is superintendent and Walt Hill, office manager. The second spread has its office at Camp Point, Illinois. Floyd Lewis is superintendent.

Between Salisbury, Missouri, and Wood River, Illinois, about 425 miles of 8 and 12-in. pipe is being taken up and reconditioned for Sinclair. Two spreads are engaged on this job also. One is at Mexico, Missouri, where Paul E. Thibodeaux is superintendent and Guy Carder office manager. At St. Peters, Missouri, a second crew is in charge of "Whitey" Gould.

Work on the Platte Pipe Line job has had to be shut down because pipe has run out due to the steel strike. This consists of 120 miles of 20-in. from Salisbury to St. Joseph, Missouri. The field office has been at Cameron with Al Perry superintendent and Bill Clyma office manager.

Comstock Midwestern, Ltd., 206 Laird Drive N. Leaside, Ontario, Canada, has been at work since late in May on 472 miles of 24-in. pipe line for Trans-Mountain Oil Pipe Line Company, which will extend from Edmonton, Alberta, to Vancouver, British Columbia. The central project office is at 3390 Kingsway, Vancouver. The telephone number is Dexter 5511. C. C. Bledsoe is project manager, Charles Rathgeb, Jr., assistant project manager, M. T. "Bill" Wilhite general superintendent, A. T. Tolbert assistant superintendent, and Mike Seville office manager. The two spreads are located as follows:

Jasper, Alberta: John Work spreadman, D. E. Anderson office manager, and Herb Allen master mechanic.

Red Pass Junction, British Columbia: "Mope" Work spreadman, N. O. Boies office manager, and Ralph Burnett master mechanic.

From the field office at Woodstock, Ontario, 171 miles of 6, 10, and 12-in pipe line is being laid for the Sarnia Products Pipeline Company between London and Toronto. Denver L. Franklin is superintendent, Alma M. King office manager, C. M. Michael master mechanic, and Jasper Peck chief inspector.

Tulsa - Williams Company, National Bank of Tulsa Building, Tulsa, Oklahoma, has its central office at Danbury, Connecticut, for the project involving the laying of 143 miles of 10, 24, and 26-in. pipe for Algonquin Gas Transmission Company. R. L. Buck is general superintendent, R. E. Higgenbotham office manager, and George Littlejohn project engineer. Three spreads are:

Denville, New Jersey, O. R. Mitchell superintendent, L. L. Fitzgerald office manager, and Jim Martindale master mechanic.

Suffern, New York, Whitey Martin superintendent, and Jack Mackie, office manager. Waterbury, Connecticut, T. E. Davis, superintendent, Walt Smeltz office mnager, and C. D. Cox master mechanic.

H. L. Gentry Construction Company, 921 East Michigan Avenue, Jackson, Michigan, has begun work on 77 miles of 16-in. between Macungie, Pennsylvania, and Linden, New Jersey, for the Buckeye Pipe Line Company. The field office is at Cooperstown, Pennsylvania. Frank Morris is general superintendent, A. J. Brown spreadman, and O. W. Gartin office manager.

For Natural Gas Company of West Virginia, 20 miles of 8 and 10-in. are being laid from Lisbon to Sebring, Ohio. Newton Dukes is foreman and Don Sawyers office manager.

In the vicinity of Syracuse, New York, 20 miles of pipe 10-in. through 24-in. is being laid for Niagara Mohawk Power Corporation. R. L. Cantrell is foreman Bob Groth office manager, and Hap Armstrong foreman of welders.

Fulton and Brodie Construction Company, P. O. Box 2064, Amarillo, Texas, which has been laying 142 miles of 20-in. on the Platte Pipe Line, has shut down due to lack of pipe. The section is between Holdrege and Odell, Nebraska.

Conyes Construction Corporation, 2884 San Pablo Avenue, San Pablo, California, is laying 320 miles of 10 and 12-in. pipe line in Ohio and Illinois for the Ohio Oil Company. The project office is at Mansfield, Ohio, with Al Poggi general superintendent and Fred King office manager.

At Vandalia, Illinois, Morris Norwood is superintendent, "Peanuts" Kinkaid assistant superintendent, Dick Comstock office manager, and J. W. Trim master mechanic.

At Kenton, Ohio, J. L. Walker is superintendent, and E. E. Haworth office manager.

R. H. Fulton and Company, P. O. Box 1526, Lubbock, Texas, have had to close down work on the Platte Pipe Line due to lack of pipe. This contractor has been laying 443 miles of 20-in. pipe between Casper, Wyoming, and Holdrege, Nebraska.

The Sinclair job between Humboldt, Kansas, and Salisbury, Missouri, has been completed, and work is ready to begin on 100 miles of 26-in. loops for Northern Natural Gas Company in Kansas and Nebraska.

Rumsey Brothers Pipe Line Construction Company, 4039 North Broadway, Wichita, Kansas, has run out of pipe and shut down work on the Platte Pipe Line Company job. This contractor has been laying 100 miles of 20-in. between Marysville, Kansas, and St. Joseph, Missouri. The field office has been at Hiawatha, Kansas, with Myrl Rumsey superintendent and Glenn Stitt office manager.

Canadian-Parkhill Pipe Stringing, Ltd., Toronto, Canada, is stringing approximately 200 miles 6, 10, and 12-in. for Imperial Oil, Ltd., from Sarnia to Toronto, Canada. Contractor, Comstock-Midwestern, Ltd. Superintendent, Curtis Williams.

469 miles of 24-in. for Trans Mountain Oil Pipe Line from Acheson, Alberta, to Burnaby, British Colombia. Contractors: Comstock-Midwestern, Ltd., and Canadian Bechtel. Superintendent, Jack Williams.

360 miles of 10-in. for Trans-Northern Pipe Line Company from Hamilton, Ontario, to Montreal, Quebec, Canada. Contractors: Sparling and Davis Company, Ltd., and Williams Brothers.

Oklahoma Pipe Line Constructors, 6612 Hines Boulevard, Dallas, Texas, has the following schedule:

70 miles 30-in. for United Gas Pipe Line Company from Houston to the south bank of the Trinity River. This job started about June 15, with Louis Visentine the superintendent in charge. Field office is in Conroe, Texas.

116 miles 30-in. pipe for Tennessee Gas Transmission Company. This job is in three loops along Tennessee's main line from Refugio, Texas to Cleveland, Texas. One field office is at Rosenberg. Hank Scherrer, office manager; P. J. Walden, timekeeper; W. E. Lawrence, material man; Ernest Cox, right-of-way; E. B. Davis, stringing; Chester Lake, ditch; Hubert Howell, bending; "Big Jim" Hickman, pipe; A. J. Blakeley, welder; W. C. "Dub" Martin, dope; Newman Myers, lower-in; Frank Post, clean-up, and Elmer Prince, master mechanic. A second spread is now working out of Cleveland under Raymond Law, Henry Turner in charge of office.

The 68 miles of 24-in. being laid as a joint venture with Houston Contracting Company for Rancho Pipe Line Company, between the Shell refinery at Pasadena and the Brazos River, was shut down when pipe ran out.

J. E. Young Pipe Line Contractor, Inc., 931 East Rosecrans Avenue, Los Angeles, California, began work July 1 on 41 miles of 8⅝-in. pipe line for the Southern California Edison Company. The pipe is being laid between Santa Fe Springs and Etiwanda. Jack Cook is project superintendent and Ronny Cook spread superintendent.

Reece Brothers Construction Company, Hugoton, Kansas, continues with its work on 170 miles of 4, 6, 8, and 12-in. gathering line in the Hugoton area for Northern Natural Gas Company. Paul Reece is general superintendent, Gale Reece spreadman, and Lloyd Patterson office manager.

Fulghum Contracting Corporation, Harrisburg, Pennsylvania, has sub-contracted from Associated Pipe Line Constructors, Inc., 100 miles of 4, 6, and 10-in. on the Algonquin Gas Transmission Corporation system. The pipe will be laid in Massachusetts and Rhode Island.

H. C. Price Co.—Somastic Division, P. O. Box 1111, Bartlesville, Oklahoma, has the following jobs in progress at its Bustleton, Pennsylvania, plant:

Philadelphia Gas Works Company — Application of Somastic coating to approximately 114,086 ft of pipe ranging in size from 1 to 30 in.

Okonite-Callender Cable Company — Application of Somastic coating to 11,005 ft of 6-in. pipe.

Philadelphia Electric Company—Application of Somastic coating to 9345 ft of 6-in. pipe and 96,184 ft of 8-in. pipe.

Buckeye Pipe Line Company — Application of Hevicote to 2216 ft of 16-in.

Gulf Oil Corporation—Application of Somastic coating to approximately 52,135 ft of pipe ranging in size from 6 to 24 in. Application of Hevicote to 1800 ft of 8-in. pipe; 6300 ft of 12-in. pipe, and 1200 ft of 16-in. pipe.

At the Harvey, Louisiana, plant Somastic coating is being applied to 9700 ft of 18-in. pipe and 8500 ft of 4½-in. pipe for Richmond Exploration; pipe to be shipped to Maracaibo, Venezuela.

Banister Construction, Ltd., 609 Northern Hardware Building, Edmonton, Alberta, Canada, began work July 25 on 28 miles of 4-in. between Brock, Saskatchewan, and Kindersley, for the Saskatchewan Power Corporation. Five miles of 4 and 6-in. are being laid to the Devon gasoline plant of Imperial Oil, Ltd. On July 20, the contractor completed 12 miles of 6-in. in the Colville field for the Royalite Oil Company.

Anderson Brothers Corporation, 6300 Navigation Boulevard, Houston, Texas, has two spreads at work on 107 miles of 30-in. pipe line for Tennessee Gas Transmission Company in Mississippi and Tennessee. In Tennessee, a 37-mile section is being laid between Selmer and Parsons. The field office is at Henderson, with "Rusty" Killingsworth superintendent, Russell McDowell office manager, and C. L. Fleming master mechanic. In Mississippi, a 33-mile section will be laid from Greenville to Drew and a 37-mile section from Holly Springs to the Mississippi-Tennessee state line. A field office has been opened at Holly Springs with A. B. Haynes superintendent.

Work on the Rancho Pipe Line Company system has been shut down due to lack of pipe. This consists of 267 miles of 24-in. from McCamey to Cedar Valley, Texas. The field office has been at El Dorado with Aldress Kilgore superintendent and K. R. Smith office manager.

Sparling-Davis Company, Ltd., 7310 99th Street, Edmonton, Alberta, Canada, is laying 185 miles of 10-in. line for Trans-Northern Pipe Line Company from Toronto to Hamilton. Key personnel are as follows: D. E. Deaton, spreadman; C. R. Beighle, office manager; Tom McLeod, right-of-way foreman; "Shorty" Erard, ditch; D. Matthews, pipe; B. Doyle, lowering-in; Jim Kerr, clean-up, and "Pinky" Bolin, welding.

The contractor also is installing a crossing of the South Saskatchewan River in the Province of Saskatchewan for the Interprovincial Pipe Line Company. C. S. Wiltshire is superintendent and Vernon Longston foreman.

Somerville Construction Company, Ada, Michigan, is laying 12 miles of 6-in. pipe at Paris, Illinois, for the Central Illinois Public Service Company, and 7 miles of 6-in. at Morton, Illinois. Pete Hiner is spreadman on both jobs. For Michigan Gas Utilities Company 9 miles of 4-in. pipe is being installed at Dundee, Michigan. Bob Miller is spreadman.

Western Construction Company, P. O. Box 1135, Hobbs, New Mexico, is making its headquarters at Harlingen, Texas, on 105 miles of 8-in. pipe being laid for Continental Pipe Line Company between Port Isabel and the Rincon field. Morris Lasley is the superintendent.

Percy Jones, Inc., P. O. Box 1083, Oklahoma City, Oklahoma, is hauling and stringing 14 miles of 20-in. and 2 miles of 26-in. pipe for Cities Service Gas Company from a point near Independence, Kansas, to a point near Liberty, Kansas. For the same company, 10 miles of 4-in., 10 miles of 6-in., and 12 miles of 16-in. pipe is being hauled and strung in the Liberal-Sublette, Kansas, area. Between Welda and Richmond, Kansas, 20 miles of 16-in. reclaimed pipe is being hauled for Cities Service. For Shell Pipe Line Corporation, 20 miles of 6-in. reclaimed pipe is being hauled. This is from a point northwest of Newton to Wichita, Kansas.

Contractors

Parkhill Truck Company (Stringing Contractor), P. O. Box 1856, Tulsa, has the following jobs underway.

280 miles 14-in. line and 320 miles of 8-in. take-up for Shell Oil Company, from Wood River, Illinois, to East Chicago, Indiana.

100 miles of 16-in. and 125 miles of 3 to 8-in. scattered sections in Connecticut, Massachusetts, and New Hampshire for Northeastern Gas Company. Contractor: Bechtel Corporation. R. C. Parker, superintendent.

Approximately 60 miles of 30-in. for United Gas Pipe Line Company from Sterling, Louisiana, to Clarence, Louisiana. Contractor: River Construction. Foreman, Charles Sampson.

Midwestern Constructors, Inc., 105 North Boulder, Tulsa 3, Oklahoma, makes this construction progress report:

Aluminum Ore Company, Bauxite, Arkansas. Process piping, fabrication, 60 per cent completed; installation, 40 per cent completed. Earl S. Powell, superintendent, Morris Garey, office manager; Jack Graham, Elwood Rolfs, and Ralph Bray, area superintendents.

The Texas Company, Salem, Illinois. 89,000 ft of water line from Kaskaskia River to Salem field, Marion County, Illinois, 90 per cent completed. Mac Hoffman, superintendent, and Robert E. Klang, office manager.

Natural Gas Pipeline Company of America, Chicago, Illinois. Manifold alterations at station 107, Emerson, Iowa; 15 per cent completed. Walter D. Smith, Jr., superintendent; Dale Baird, engineer, and O. L. Westrum, office manager.

Manifold alterations at Station 108, Truro, Iowa, 15 per cent completed. Orrin J. Watrous, superintendent; Pat T. Moore, engineer, and R. E. Brewer, office manager.

Sinclair Pipe Line Company, Independence, Kansas. Construct pump station, Quincy, Illinois; 15 per cent completed. Ray M. Johnson, superintendent; Charles Malone, engineer, and W. D. Kaufman, office manager.

Install piping at Humboldt, Kansas, station; 10 per cent completed. W. E. Taylor, superintendent, and J. A. Stokes, office manager.

Construct pump station, Pontiac, Illinois; just starting (awarded 6-23-52). K. L. Kreamalmyer, superintendent; Fred Trompler, engineer, and Duane C. Routh, office manager.

Anderson International Constructors, Ltd., Room 30, Miller Building, Edmonton, Alberta, Canada, is a month and a half along with the 100 miles of 16-in. for Interprovincial Pipe Line Company. The work is between Regina, Saskatchewan, and Superior, Wisconsin, a loop to the central portion of Interprovincial's system. The field office is at Glenboro, Manitoba. Dick Jernigan is superintendent, A. H. Brown assistant superintendent, C. C. Lazier office manager, and Matt Rachel master mechanic.

Harford Brothers Pipe Line Construction Company, Emporium, Pennsylvania, is laying approximately 75 miles of 10-in. pipe line for the Lake Shore Pipe Line Company, extending from Cochranton, Pennsylvania, to Ashtabula, Ohio, then west to Fairport Harbor, Ohio. The field office is at Lineville, Pennsylvania. A. M. and W. E. Harford are supervising the work. Earl Dell is spreadman and W. Q. Harris office manager.

Bechtel Corporation, 220 Bush Street, San Francisco 4, California, has four spreads in the field laying 225 miles of pipe line in Connecticut, Massachusetts, and New Hampshire for the Northeastern Gas Transmission Company. Of this total, 100 miles will be 16-in. pipe and 125 miles 3, 4, 6, and 8-in. The job office is at 7 West Main Street, Plainville, Connecticut. S. D. Bechtel, Jr., is division manager; R. L. Bowman, general superintendent, and W. H. Molander, senior office manager.

The spread offices are as follows:

Spread 1: 7 West Main Street, Plainville, Connecticut; V. L. Williams, superintendent.

Spread 2: 52 Pulaski Street, Stamford, Connecticut; J. L. Work, superintendent.

Spread A: P. O. Box 181, Derry, New Hampshire; D. B. Alexander, superintendent.

Spread B: Winsted, Connecticut; M. A. Roberts, superintendent.

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Shape cutting Attachments for cutting the various shapes of pipe intersections.
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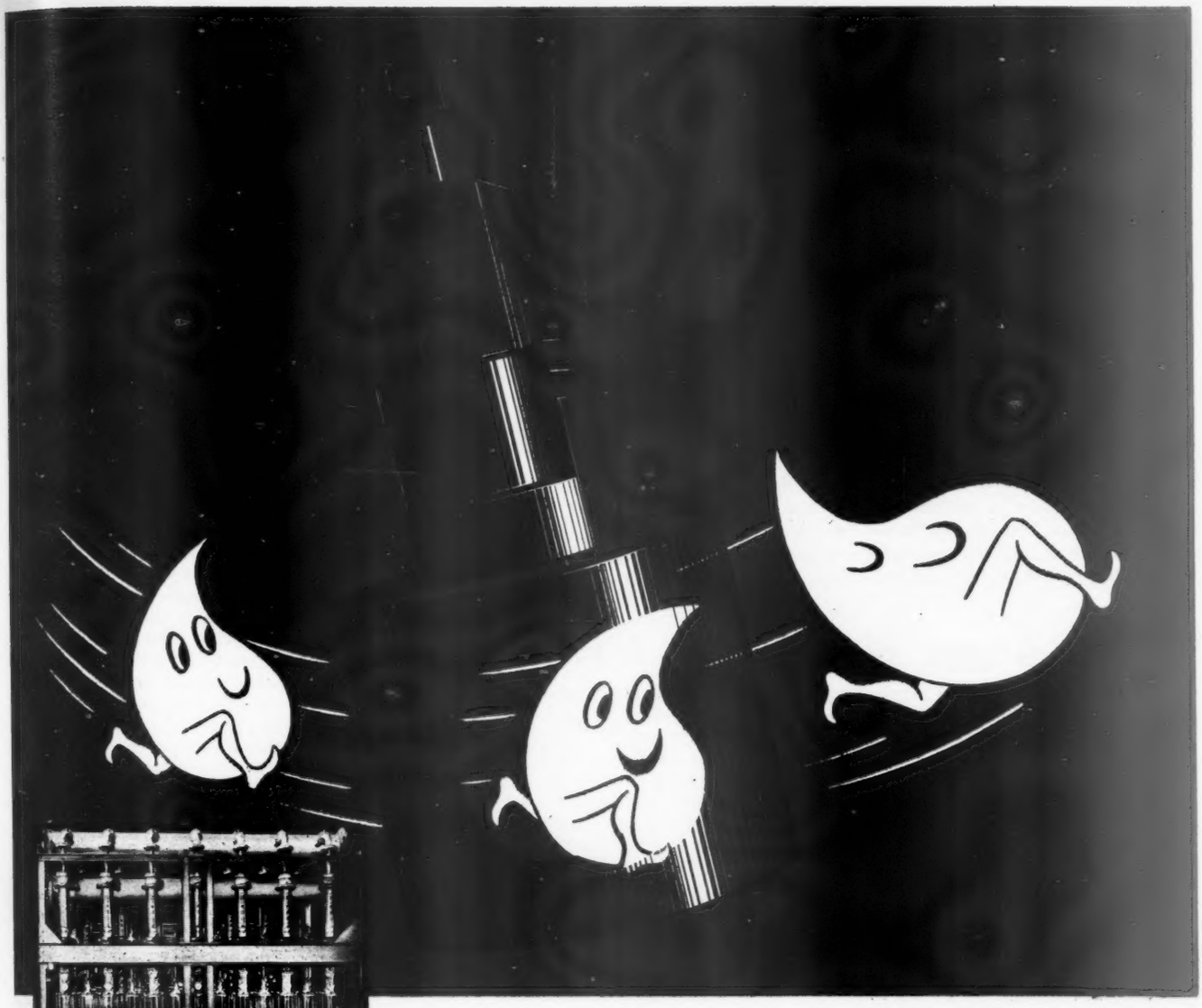

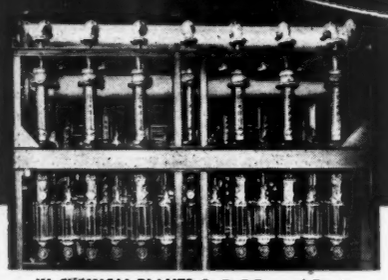

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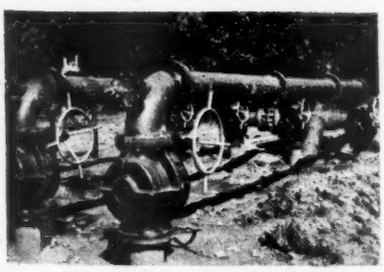

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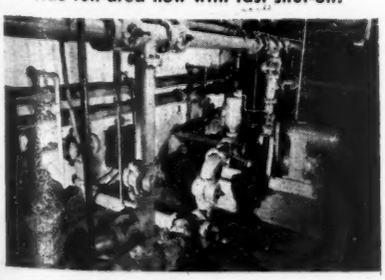

IN SEWAGE PLANTS a.c.f. Valves offer uninterrupted flow. CYLINDRICAL plug actually shears obstructions.

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The passage of an a.c.f. Round Port Lubricated Plug Valve exactly conforms to the size and shape of the pipe. Ideal for capacity flow of abrasives and suspensions, these valves have the same quick, quarter-turn shut-off feature of rectangular port a.c.f. CYLINDRICAL "Full Pipe Area" Plug Valves. In addition, an a.c.f. Valve cannot wedge in its seat. Why tolerate a less efficient valve?

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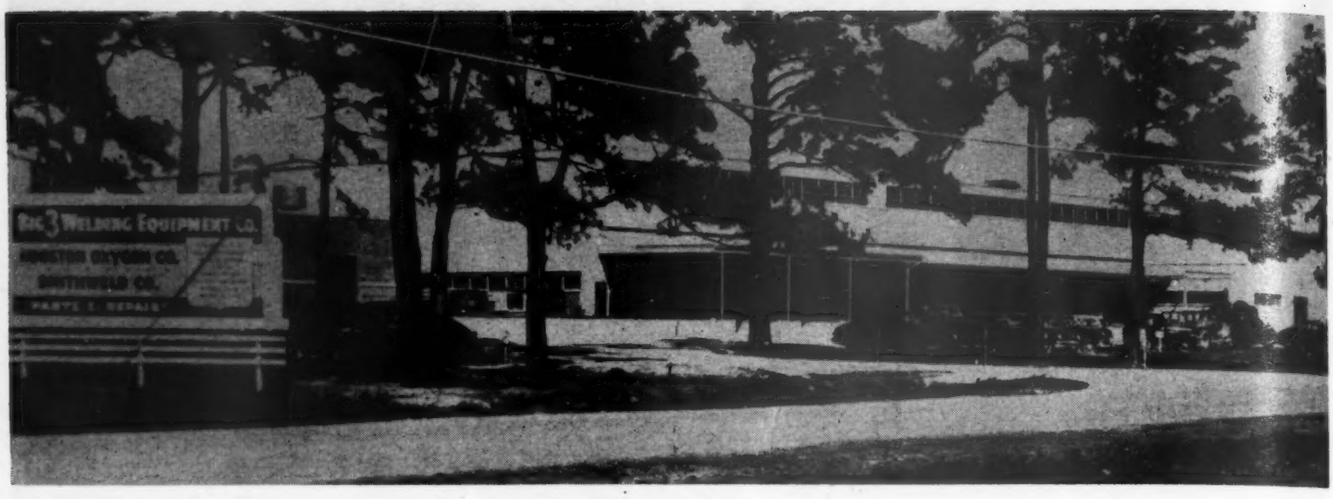
Write for Catalogue 4-PE, American Car and Foundry Co., Valve Division, 1501 E. Ferry Ave., Detroit 11, Mich.

Representatives in 50 Principal Cities



Houston plant (left and center of photo) of the Houston Oxygen Company, adjoins new plants (to extreme right) of two affiliate companies: Big Three Welding Equipment Company and Smithweld Company. At extreme left, behind the sign, is the carbide and acetylene warehouse building. These two products are made at another of the company's Houston plants.

Houston Oxygen Plant Supplies Industry

The Houston Oxygen Company recently placed in operation at Houston, Texas, its million-dollar plant for the production of pure oxygen, nitrogen, and argon gases. This is the first oxygen plant of its type in the nation operated by an independent company and was built to serve the rapidly expanding needs of the Southwest's industrial development.

Simultaneously, meters started ticking on the world's first pipe line to supply industrial customers with pure, dry oxygen gas.

The plant's products has many uses, playing important roles in petroleum drilling, production, refining, and transportation; in the manufacture and fabrication of steel and other metals; in medicine and surgery; science and research; ship building and shipping; fire-fighting; aviation, war equipment, and the manufacture of countless products essential to the national economy.

The oxygen industry utilizes the world's only free raw product, air. Liquid oxygen bubbles and looks like boiling water. It pours like water, but is strongly magnetic and somewhat resembles the action of mercury. The temperature of liquid oxygen, as drawn from the final processing, is minus 183 C and it rapidly evaporates, giving off a steam-like vapor. Liquid oxygen cannot be stored or carried in a sealed vessel because the creation of vapor is continuous and it would, if confined, quickly build up a pressure and cause a violent and dangerous explosion. It is, therefore stored in heavily insulated tanks to resist temperature loss and consequent evaporation.

Liquid nitrogen is as colorless as water, but otherwise looks and acts very much like liquid oxygen. Its temperature, as drawn from the final processing, is minus 196 C, and it must be handled similarly to liquid oxygen.

Part of the dry oxygen gas produced in the new plant feeds into the Industrial Oxygen Pipeline, a 3-in. line that runs southeast from the plant almost to the Hempstead and Katy roads. At present it is supplying many large industrial plants and rights-of-way have been granted to extend it another four miles due west along Katy Road to supply other users of oxygen. The plant is strategically situated so that additional pipe lines can be run in various directions to supply other fast-developing industrial areas in Houston.

The pipe line is operated at a pressure of 100 psi. Dry oxygen gas of 99.5 per cent or greater purity is delivered to customers. Each customer has a meter for measuring consumption, the system being much like a fuel-gas line.

Customers not served by pipe line are provided with large banks of permanently placed tubes for the storage of oxygen. These tubes are 20 ft long and some banks contain as many as 50 tubes. A fleet of specially constructed tank trucks transports the liquid oxygen under atmospheric pressure to these storage banks.

These liquid oxygen trucks are used also to supply large and moderate-sized users of industrial oxygen, each of which has a liquid oxygen storage tank and a converter unit to generate dry oxygen gas on the premises for use as needed.

Officials of the Houston Oxygen Company are Alfred K. Smith, president; Cyrus K. Rickel, vice president; Harry K. Smith, director, and Al Herzstein, secretary-treasurer and general manager. These men also are officials of a group of eight affiliated companies. The largest of these is the Big Three Welding Equipment Company of Houston and Fort Worth and 16 other key cities. The oxygen plant adjoins Big Three's new million-dollar plant opened last October.

Officials of the Houston Oxygen Company are: Alfred K. Smith, president; Cyrus K. Rickel, vice president; Harry K. Smith, director; and Al Herzstein, secretary-treasurer and general manager.

New Experiment Station Set

Award of a contract for building a new Bureau of Mines experiment station at Morgantown, West Virginia, to the Southeastern Construction Company, of Charleston, West Virginia, was announced by Secretary of the Interior, Oscar L. Chapman.

By approving the contract for the construction of buildings, driveways, and other facilities, Secretary Chapman authorized the beginning of the largest construction job yet carried out by the Bureau of Mines, except for the synthetic liquid fuels facilities. The authorized cost of the station is $2,600,000.

The principal activities initially planned for the station, J. J. Forbes, director of the Bureau of Mines, said, include:

1. Research on the production from coal of synthesis gas, (2) headquarters for mining studies and health and safety work, and (3) headquarters for the Bureau's petroleum and natural gas research in the Appalachian region.

Oil Men End Informational Tour of Williston Basin

A whirlwind tour of 17 North Dakota and Montana communities has just been completed by a panel of six oilmen who spoke on various activities of the industry and conducted open forums attended by more than 4000 farmers, businessmen, and landowners in the Williston Basin area.

The informational tour was sponsored by the junior chambers of commerce of the two states, and the panel was convened by the Williston Basin subcommittee of the Oil Industry Information Committee, headed by H. L. Curtis of Shell Oil Company.

The speakers, each an expert on some particular phase of the industry, presented a condensed picture of the past, present, and future of oil operations in the area.

The moderator was T. N. Jordan, president of Illinois Southern Oil and Gas Company. The speaker on production was E. R. Shorey, Jr., mechanical engineer with Shell. Exploration was handled by Charles S. Agey, assistant chief geologist with Amerada Petroleum. Economics was discussed by Clarence W. Nelson, assistant economist of the Federal Reserve Bank of Minneapolis. Gordon C. Locke, executive secretary and associate counsel to the Committee for pipe line companies, spoke on transportation, while the subject of refining was taken by C. F. Smith, assistant general superintendent of Standard Oil (Indiana), Whiting refinery.

These men outlined the oil industry's activities and answered questions at public meetings in 17 Williston Basin communities during a recent 10-day tour. They are: C. F. Smith, Gordon C. Locke, E. R. Shorey, Jr., Charles S. Agey, C. W. Nelson, and moderator, T. N. Jordan.

Preliminary Program Set for NACE Meeting in New Orleans

Design against corrosion and engineering approaches to the solution of corrosion problems will be the principal themes of the technical program of the South Central Region of the National Association of Corrosion Engineers' meeting at New Orleans October 1-3. An outline calling for the presentation of 18 papers in four symposia has been prepared by John E. Loeffler, of Thornhill-Craver Company, Houston, technical program chairman.

Two unusual features have been proposed for the program and both are well under way to complete organization. One is the presentation of a Technical Practices Committee Report by a subdivision of TP-1 on corrosion of oil and gas well equipment. The other will consist of four discussions of corrosion work done by other petroleum industry associations and the relation of the work of these other groups to similar work in the NACE.

Areas covered by the symposia are those selected in a canvass of interest of South Central Region's membership made in 1951. Subject matter is keyed to the petroleum and petrochemical industries, to the pipe line transportation field and to the marine exposure field. These subjects were those in which most interest was expressed in the canvass. All activities will be at the Jung Hotel.

Four Symposia Projected

The program projected, officials, and the titles of papers and names of authors arranged for at this time are:

Wednesday, October 1. 2:00 p. m. Cotillion Room, Report of TP-1H on Corrosion of Oil String Casing. Jack L. Battle, Humble, chairman, presiding.

Thursday, October 2. 9:00 to 11:45 a. m. Tulane Room. Oil and Gas Industry Symposium. Edward C. Greco, production department, United Gas, chairman; D. F. Dial, production department, Pure, co-chairman; aides, D. A. Shock, Continental and Robert C. Booth, Shell.

Mill Scale on Steel and Its Effect on Steel Corrosion in Salt Water, by T. P. May and R. B. Teel, International Nickel, Inc.

Bacterial Corrosion of Offshore Structures, by J. A. Caldwell and Mrs. M. L. Lytle, Humble.

Review: Use of Sodium Chromates and Alkalies for Controlling Corrosion in Gas Condensate Wells, Kenneth C. Eilerts, Department of Interior, Bureau of Mines.

Oil Well Inhibition, Frank C. Bird, California Company.

Gasoline Plant Corrosion, Maryann Duggan, Magnolia.

2:30 to 4:45 p. m. Processing Plant Symposium. Sam Muery, Freeport Sulphur, chairman; Ray Cherry, Monsanto Chemical, co-chairman; aides, Clyde C. Loyd, Esso Standard, Alan Whitehead, Metal Goods.

Oil Refinery Corrosion Problems, W. A. Trusty, Arkansas Fuel.

Plastic Materials of Construction, K. B. Seymour, Atlas Mineral.

Designing to Prevent Corrosion, Fred A. Prange, Phillips.

Statistics, A Useful Tool for the Examination of Corrosion Data, C. F. Lewis, Cook Heat Treating.

Friday, October 3. 9:00 to 11:45 a. m. Oil and Gas Transportation Symposium. K. D. Wahlquist, Southern Union Gas, chairman; F. E. Pyeatt, Jr., Mid-Continent Pipe Line, co-chairman; aides, J. A. Holloway, Houston Pipe Line; Sidney Trouard, Jr., New Orleans Public Service.

Pipe Line Coatings, by F. W. Fair, Jr., Koppers.

A New Development in Magnesium Anodes for Pipe Line Cathodic Protection, by R. C. Jorgerson and Burke Douglas, Dow Chemical.

Cathodic Protection of Uncoated Pipe Lines, by Joe F. Tatum, Willmut Gas and Oil.

The Tank Ship and Its Corrosion Problems, by J. D. Sudbury and D. A. Shock, Continental.

Inspection of Transportation Equipment to Prevent Corrosion and Failure in Use, Geo. L. C. Dehn, Magnaflux.

2:00 to 4:45 p. m. Oil and Gas Transportation Management and Economics Symposium. Earl W. Unruh, Sinclair Pipe Line, chairman; aides, C. D. Hall, Thornhill-Craver, W. E. Weidler, Jr., Aluminum Company of America.

Review of Some of the Work of a Typical API Pipe Line Sub-Committee on External Corrosion Protection of Crude Oil Pipe Lines and Its Relation to Similar Work in NACE, by L. F. Scherer, Texas Pipe Line.

Review of Some of the Work of a Typical API Sub-Committee on Internal Corrosion Protection of Crude Oil Pipe Lines, by R. A. Brannon, Humble Pipe Line.

Review of Some of the Work of a Typical AGA Sub-Committee on Pipe Line Corrosion and Its Relation to Similar Work in NACE, by A. D. Simpson, United Gas.

Review of Corrosion Topics Studied by the Petroleum Industry Electrical Association's Corrosion Committee and Its Relation to Similar Studies by NACE, by A. L. Stegner, Tennessee Gas.

Progress of Some of the Research in Corrosion Problems of Large Diameter Product Pipe Lines, by Ivy M. Parker, Plantation Pipe Line.

An additional paper in this symposium is proposed in which accounting procedures pertaining to corrosion will be covered.

Other Activities Planned

Other activities which have been scheduled tentatively include:

October 1. Registration and committee meetings all day. Names of technical committees have not been announced.

October 2. 12 to 2:00 p. m. Lunch and annual business meeting. Field trips. Choice between a visit to Rheem Manufacturing Company plant or the Kaiser Aluminum Company plant is expected to be offered.

Entertainment will be offered to attendants in the evening.

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By manufacturer—6 No. 1 Pure Manila Bull Ropes, 3" diameter by 150 feet, weighing about 270 pounds each, 25 cents per pound F.O.B. Hobbs, New Mexico. Box 140, % The Petroleum Engineer, P.O. Box 1589, Dallas, Texas.

NEW WILLISTON BASIN OIL MAPS

Up-to-Date Williston Basin Map, covering North and South Dakota, Montana, Wyoming. 42"x48"—$10.00 Paper, $17.50 Cloth. Also County Ownership and Lease, State, Combination, Trend and Field Maps.

AUSTIN MAP COMPANY

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MALE HELP WANTED

Superintendent for large Solvent Recovery Plant. Chemical Engineer with Petroleum Industry background preferred. Reply giving details regarding experience, education and salary desired, Box No. 141, % The Petroleum Engineer, P.O. Box 1589, Dallas, Texas.

EXECUTIVE POSITION OPEN FOR PETROLEUM RESERVOIR ENGINEER

To assume entire administration and technical responsibilities of Petroleum Production Engineering and Evaluation Department with pioneer reservoir engineering company. Must have above-average academic and professional background, specializing in secondary recovery work. Must have sound knowledge of legal and financial aspects of unitization programs, property evaluation, etc. Top bracket compensation, plus participation. Send complete resume, including age, to Box 143, % The Petroleum Engineer, P. O. Box 1589, Dallas. Texas.

Tax Certificates Granted For 792 Projects by May 30

Petroleum Administration for Defense as of May 30, 1952, had approved applications for accelerated tax amortization on $2,461,878,000 of the cost of 851 oil and gas projects, Secretary of the Interior Oscar L. Chapman has announced.

As of that same date Defense Production Administration had issued necessity certificates for accelerated amortization on $2,266,189,000 of the cost of 792 projects. Balance of the PAD recommendations for approval were still being reviewed by DPA.

A tabulation of PAD actions on the applications in the general classifications of the industries' operations follows:

	Projects filed	Approved	Denied	Value approved
Basic refining	321	227	29	$998,108,000
Crude and product storage and transportation	394	245	59	536,583,000
Gas transmission, distribution, manufacture, and storage	69	39	20	270,144,000
Alkylation, aromatics, and tetraethyl lead	120	116	0	219,440,000
Natural gasoline	172	118	29	186,418,000
Petro-chemicals	58	25	10	129,278,000
Lubricating oil and lube-oil additives	51	31	16	64,916,000
Cracking catalyst	16	13	0	27,421,000
Sulfur	36	31	1	21,687,000
Oil field equipment and machinery	38	6	27	7,883,000
Production	1	0	1	0
Marketing facilities	2	0	2	0

Capacities represented by the applications to which PAD has given approval are the following.

Natural-gasoline processing	200,000 barrels a day
Basic refining	1,278,000 barrels a day
Lubricating oil	5,900 barrels a day
Lube-oil additives	10,900,000 pounds a month
Cracking catalyst	12,600 tons a month
Sulfur	427,945 long tons a year

Refinery Increases Urged

PAD's deputy administrator, J. Ed Warren, urged refiners to turn out more fuel oil, adding that production between July and March of next year must average 948,000 bbl daily to meet requirements next winter on the East and Gulf Coasts. The "required level of distillate production" would be 18 per cent greater than the average output of 802,000 bbl daily during the July through March period of 1951-52, he stated.

Petroleum Equipment Supply Association officers recently elected are: David D. Bovaird, vice president, Bovaird Supply, Tulsa, Oklahoma, and Mason B. Jones, president, S. M. Jones Company, Toledo, Ohio. Not shown are: Whorton Weems, treasurer, re-elected, Vinson, Elkins and Weems, Houston, Texas, and H. R. Safford, Jr., executive secretary.

U. S. Reports Rise

Imports for the week of July 12 totaled 774,700 bbl up 54,000 from the week before, according to an American Petroleum Institute report. Total imports for the four weeks preceding July 12 totaled 836,900 API reported.

Week ended	Crude oil	Residual oil	Others	Total
	(Figures in barrels per day)			
June 14	614,100	207,400	47,900	869,400
June 21	578,100	275,400	853,500	853,500
June 28	636,200	345,000	18,000	999,200
July 5	574,700	119,300	26,400	720,400
July 12	540,300	218,100	16,300	774,700

PAD Export Figures Out

The Petroleum Administration for Defense has published the following summary of exports of major petroleum products from the United States. Figures are given in thousands of barrels daily and include products exported by tanker and barge movements only.

Week ending	Avgas*	Motor gasoline	Kerosine	Distillate	Residual	Total
May 30	4.2	16.7	....	63.8	79.3	164.0
June 6	26.3	12.5	24.2	85.7	88.6	237.3
June 13	46.4	7.7	25.4	146.5	52.6	278.6
June 20	26.6	17.9	28.7	127.4	89.7	290.3

* Avgas is partly estimated and includes all method of shipment.

Tulsa Oil Show Housing Bureau Opens August 1

The International Petroleum Exposition Housing Bureau office for the May 14-23, 1953 show in Tulsa, Oklahoma, opened August 1 at 616 South Boston in Tulsa, according to Barton A. Myers, bureau committee chairman.

Requests for hotel accommodations should be sent in as soon as needs can be ascertained, but it is emphasized that no action will be taken to confirm hotel reservations until January 15, 1953.

Listings of private rooms, homes and apartments will begin immediately and assignment of private housing units will begin in September, as soon as listings can be checked by the committee.

Wanted MANAGER ENGINEER

Must have real ability and experience in heavy machinery and refinery equipment installation and steel erection, and be able to organize and supervise all field work of varied nature employing approximately 200 riggers, ironworkers, millwrights and operating engineers.

Duties will include complete responsibility to supervise all administrative and sales functions as well as operations. Permanent substantial salaried position with well established reputable and successful engineering-contracting firm in the San Francisco Bay Area for the right man.

Give complete education and experience record in response to determine qualifications for interview. All replies will be held in confidence.,

Reply to Box 142, % The Petroleum Engineer
P. O. Box 1589, Dallas, Texas

Aramco Reports 1951 Oil Output Highest in History

Arabian American Oil Company reported in its annual report that crude oil produced in Saudi Arabia in 1951 amounted to 277,962,605 bbl, a daily average of 761,541 bbl, the highest in its history. This compared with 199,546,638 bbl produced in 1950, a daily production of 546,703 bbl.

Crude oil used to manufacture refined products at the Ras Tanura refinery totaled 58,107,534 bbl, as compared with 38,364,335 bbl of crude runs in 1950.

Two new fields were discovered during the year: Safaniya, the first field to be found in the submerged lands of the Persian Gulf, and Uthmaniyah. A total of 32 wells were drilled, of which 31 were successfully completed. Eighteen of these were in the 'Ain Dar field.

Conoco Grants Scholarships

Continental Oil Company has awarded ten 1952 high school graduates from 5 states with college scholarships. These are second annual awards to be made under Continental's college scholarship plan, formulated in 1950.

Research Facilities Merged

Trinity University and the Southwest Foundation for Research and Education have agreed to merge staff personnel and laboratory facilities for graduate teaching and scientific research purposes. Agreement, signed by both institutions' board chairmen, provides for "joining together of the two institutions in the conducting of basic research in the sciences by both staff and students."

Steel Tonnage Directed To Wildcat Drilling

Moving to meet a threatened stoppage in the drilling of wildcat exploration wells, the National Production Authority and the Petroleum Administration for Defense are taking two steps to make oil-well casing and tubing available for emergency uses, it was announced.

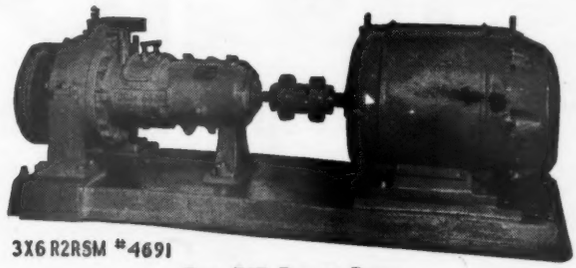
1. At the request of PAD, NPA has directed the Pittsburgh Steel Company to fill, until about August 15, orders for approximately 6400 tons of casing and tubing from its regular distributors.

2. NPA is issuing Direction 1 to Schedule 2 of NPA Order M-6A directing that no deliveries of oil country casing or tubing be made by any steel distributor except on orders bearing either the normal military and defense ratings or the allotment symbol H-2E, used to obtain emergency requirements.

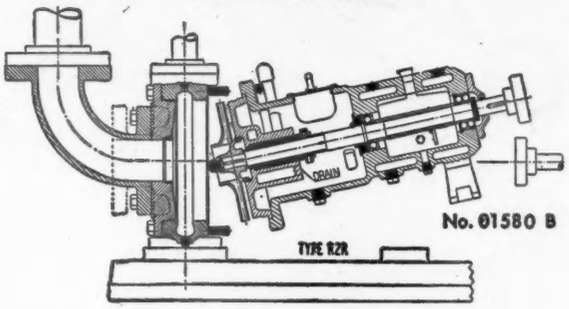
PAD has stopped issuing authorizations for purchases of casing and tubing from the emergency field stocks assigned to wildcatting for the duration of the steel strike. "Shortly after the start of the present strike PAD staff checked authorizations already issued," Warren explained. "We found that enough tickets for purchase were out to account for all of the pipe in inventory in the emergency stocks. As it is doubtful that any more pipe will be delivered to these stocks until the strike ends, we have had to stop giving priorities for purchases."

DEAN BROTHERS PUMPS INC.

Type R2R Centrifugal Process Pumps



Type R2R Process Pump



Type R2R Process Pump

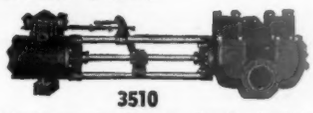
DISASSEMBLY: The Type R2R process pumps can be disassembled without disconnecting the suction and discharge piping. By first removing the spacer from the spacer type coupling, and unbolting the casing from the cradle the entire cradle and complete rotating element can be removed without disturbing the suction and discharge piping.

OPERATING RANGE: Type R2R, Heavy duty, process pumps are available in eighteen different sizes, enabling our engineers to furnish units specially designed and constructed for the particular work to be performed.
Capacities: 50 to 2000 Gallons per minute. Heads: Up to 400'. Speeds: 900 RPM to 4000 RPM.

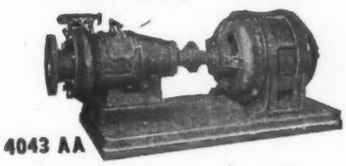
BUILDERS OF OUTSTANDING PUMPS SINCE 1869

CENTRIFUGAL AND RECIPROCATING PUMPS

Close Coupled Centrifugal Pump

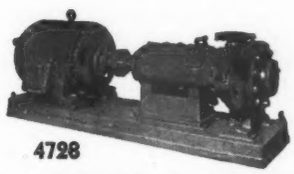


Horizontal, Single Style, Double Acting, Piston Type, Close Clearance Pump. Designed to handle volatile liquids

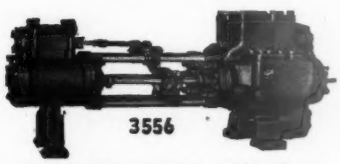


Pedestal Mounted Centrifugal Pump

Horizontal, Duplex, Double Acting, Side Pot, Piston Type, Oil Bath Power Pump



Double Pedestal Bearing Centrifugal Pump



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Oil Men Seek to Develop International Standards

A group of 32 petroleum men from 11 nations, meeting for the first time in committee session, has announced that it has drawn up and agreed on an initial program of work for developing a system of international standards for measurement and testing of petroleum and petroleum products. The two-day meetings took place at Columbia University as part of the two-week triennial session of the International Organization for Standardization (June 9-21).

K. G. Mackenzie, The Texas Company, New York, was chairman of the meeting. Leland C. Burroughs, Shell Oil, New York, headed the 14-man American delegation.

As a program for immediate future work, the committee agreed to study oil measurement tables, now under development jointly by the American Society for Testing Materials in the U. S. and by the Institute of Petroleum in the United Kingdom.

As a second item of immediate future work, the committee listed methods for determining the knock test of motor fuels by the so-called motor and research methods.

Agricultural Scholarships

Standard Oil Company of California awarded 10 high school graduates with college scholarships at a banquet held in their honor recently. Scholarships are a part of a general program instituted by Standard several years ago to help agricultural students.

Paley Group Report Is Favorable to Oil Industry

The President's Materials Policy Commission has painted a favorable report of the petroleum industry. Headed by W. S. Paley, the commission will probably lay the ground-work for policy decisions for the next 25 years or so, so its reports are highly significant.

The Paley group recommended making no change in the 27½ per cent oil-gas depletion allowance and opposes mandatory controls on "end use" of natural gas. It took no sides on the state-federal control of tidelands issue, but did urge that development of this area be prompt. On the question of synthetic fuels the commission approved government assistance rather than private oil-shale plants, but admitted that oil-from-coal needs more research.

Unlike many others the Paley report did not predict the nation was running out of oil, but expressed the belief that imports of crude oil should not be discriminated against. It expressed the belief of the group in private enterprise and added that "the spur of the profit motive" and "what is called the price system" are a part of private enterprise.

Heading the Paley Commission's petroleum section was C. J. Dyer, oil chief for Mutual Security Administration, with E. DeGolyer, Dallas, A. I. Levorsen, Tulsa, Oklahoma; Walter Levy, New York, and Serge Jurenev, Continental Oil, Houston, as consultants.

Grand Jury Begins Probe Of Alleged Oil Cartel

Federal Trade Commission has been told by President Truman to cooperate with the Department of Justice in an investigation of the "foreign oil cartel." Senator Hennings has recommended that the President make public a report turned in by the Federal Trade Commission on its investigation of the so called foreign oil cartel. The President declined to make it public but has directed Attorney General McGranery to have a grand jury probe of the case.

Hennings has protested for some time that a few large oil companies have dominated production and prices of petroleum outside the United States. The 900-page report turned in by FTC some time ago has been kept secret by the State Department on the grounds that it would adversely affect our foreign relations.

Companies McGranery has authorized the Grand Jury to investigate are:

Standard (New Jersey); Standard (California); Texaco, Socony-Vacuum, and Gulf Oil, all of the United States; and Royal Dutch Shell and Anglo-Iranian Oil Company, predominantly British concerns.

Most of the companies have issued denial of the charge.

Oil Meet Transactions Out

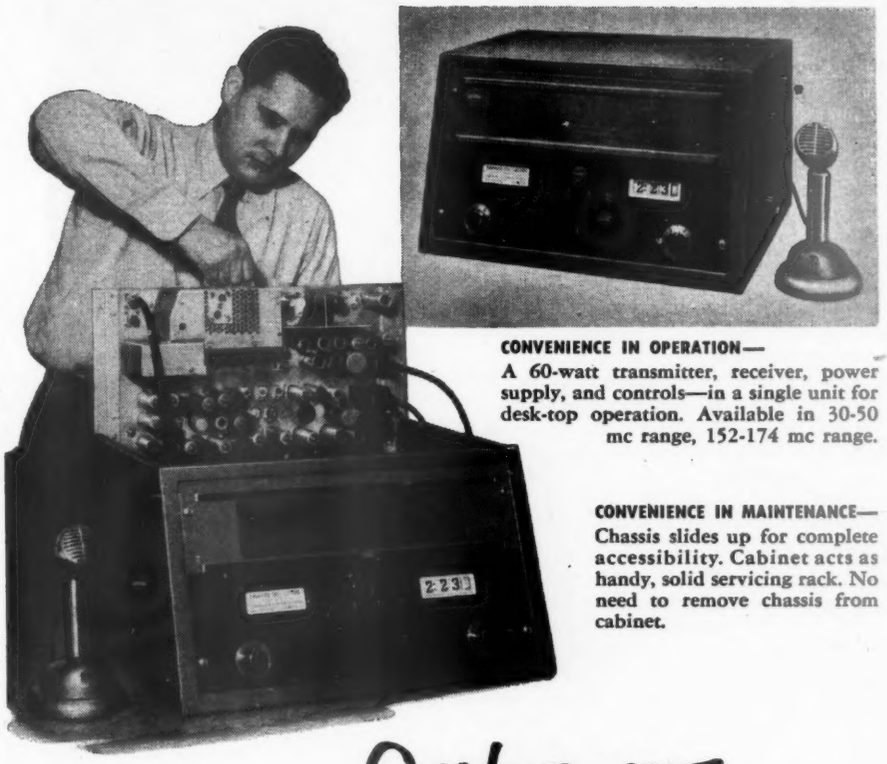
Transactions of the eighth national meeting of Natural Gas and Petroleums held in Sicily, Italy, April 21 to 24 are now available.

They are contained in three volumes of nearly 2000 pages, including figures, etc. Also included are list of members, reports of the speeches, opening and closing sessions, and additional information. Transactions are obtainable from "Ente Nazionale Metano" in Roma, (Italy) via Nomentana 92.

World Oil Output Up in January, B of M Reports

World crude production averaged 11,850,000 bbl daily in January, compared to 11,800,000 during December, according to the U. S. Department of Interior Bureau of Mines. Canadian daily production averaged 128,000 bbl, an increase of 2 per cent; and average daily output in the United States was 6,217,000 bbl compared to 6,182,000 during December. Venezuelan production was up 2 per cent, averaging a record 1,811,000 bbl daily in January. Colombia averaged 108,000 bbl daily during January, a gain of 5 per cent. In the Middle East, average daily production was down 3 per cent in Iraq and down 1 per cent in Kuwait. Saudi Arabian production remained unchanged.

Crude oil imports of western Europe averaged 1,327,000 bbl daily, an increase of 4 per cent over December. Among the major importers, United Kingdom took a daily average of 472,000 bbl, up 14 per cent. France averaged 402,000 (410,000 during December); Netherlands, 141,000 (147,000); and Italy, 151,000 (147,000).



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PERSONALS

Walter L. Keefe has been named director of the Foreign Production Division of the Petroleum Administration for Defense, succeeding **William H. Farrand.** Keefe recently retired after 31 years and seven months spent in foreign service in various branches of the petroleum industry.

Farrand is returning to The Texas Company as general manager of foreign production. He recently was elected vice president of Texas Petroleum Company in Latin America.

Keefe became shop foreman with the Mexican Gulf Oil Company in Tampico, Mexico, in 1919, and stayed with the firm for seven years. Then in 1927 he joined the Mene Grande Oil Company in Venezuela. He retired March 1, 1952 as division manager in San Tome.

W. R. Riggs has been named to the position of manager in charge of general services of Sinclair Research Laboratories, Inc. Riggs, who joined the Sinclair organization in 1932, is a chemical engineering graduate of Missouri School of Mines. His career with Sinclair has involved assignments in various divisions, including the lube research, engineering, and later as director of the pilot plant division.

R. D. Pinkerton has been named director of light oils at Sinclair Research Laboratories. The new position was recently created. Pinkerton joined Sinclair in 1930 as a partime employee while attending the University of Illinois. He joined the company full time in 1932.

E. R. Baker

E. R. Baker has been promoted to manager of Continental Oil Company's development and research department, with headquarters in Ponca City, Oklahoma. He succeeds **L. L. Davis,** who is retiring after 25 years of service with Continental.

Davis, who has been development and research manager since 1948, will continue to serve the company in a consulting capacity.

Baker joined Continental at Ponca City in 1948 as manager of the company's central research laboratories and became assistant manager of the development and research department last year. Prior to joining Continental, he had a distinguished career in chemical and research activities with several eastern firms. He received his BS degree in chemistry from Yale University.

John W. Brice

John W. Brice, who joined Standard Oil Company (New Jersey) in 1926 as a geologist, has been elected president of The Carter Oil Company. He succeeds **O. C. Schorp** who is retiring from active duty with the company.

During his service with the Standard Jersey Brice has been associated with Humble Oil and Refining in Texas, Creole Petroleum in Venezuela, Standard Jersey in New York, and Carter in Tulsa, Oklahoma. Brice will resign as chairman of the board, an office he has held since rejoining Carter last year.

Schorp began his career with the Jersey affiliates in 1920 in Mexico. During the last 32 years he also has worked in South America and New York. He has been with Carter since 1939 and has been the company's president since 1943. Schorp plans to move to Florida to make his home, but will be available to the company for special assignments on matters in which his extensive experience may be specially useful.

Herbert F. Roemmele was installed as president of the New York Chapter, New York State Society of Professional Engineers at their annual meeting at the Hotel Statler, New York, recently. For the past 25 years Professor Roemmele has served on the faculty of Cooper Union's school of engineering where he is professor of mechanical engineering and dean of students.

H. Safford Nye has been elected treasurer of Richfield Oil Corporation to succeed **M. Richard Gross,** who retired. He had been treasurer since 1937. Former vice president of Security-First National Bank of Los Angeles, Nye terminated his duties with the bank organization to assume the new post on August 1.

He is a graduate of Stanford University and received his master's degree in business administration at the Stanford Business School in 1932.

R. C. Schmidt, formerly associated with Loffland Brothers Drilling Company in West Texas, has joined the Carl B. King Drilling Company of Midland as contract representative.

O. C. Schorp

John Brook, Westfield, New Jersey, has been promoted to special assistant to the vice president and chairman of the eastern division operating committee of the Tide Water Associated Oil Company. Brook joined the company in 1924 as a statistician and in 1930 was promoted to assistant to the chief statistician. He was made assistant supervisor in the statistical department in 1940, the position he held until his present promotion.

J. R. Brown, Standard Oil Company of California, has been named president of the Petroleum Accountants Society of Los Angeles for the year that began June 1, 1952. Brown has been employed by Standard for 37 years and for the past 14 years has been office manager of the marketing department in Los Angeles.

Other officers elected: First vice president, C. F. Wilmsmeier, Western Gulf Oil Company; second vice president, V. T. Gilchrist, Superior Oil Company; secretary-treasurer, C. A. Peterson, Shell Oil Company.

James J. Cosgrove, chairman of the board of Continental Oil Company and a founding member of the American Petroleum Industries Committee, was presented an engrossed resolution of appreciation for his 19 years' service on the Committee at the APIC's meeting recently. The resolution "expresses ... appreciation for the many invaluable contributions of Cosgrove to the work of this organization ..."

Cosgrove received his AB degree from Cornell University in 1909. He received his LLB from the University of Pittsburgh in 1912.

J. C. Thompson, formerly general accountant for Magnolia Petroleum Company, is being transferred to Socony-Vacuum Exploration Company at Calgary, Canada, where he will head their producing accounting department. He is being succeeded in Dallas by **Edmund Decherd,** who has been supervisor of the general accounting office. Decherd is being succeeded by **John P. Keehan.**

H. D. Campbell

H. D. Campbell has been named president and general manager of Franco Western Oil Company in Bakersfield, California. For the last 3½ years he has served as vice president in charge of production of that company. Prior to that he was a petroleum engineer and superintendent. Campbell is a graduate of the Colorado School of Mines.

Cecil L. Burrill will take charge of the New York office of Creole Petroleum Corporation, Venezuelan affiliate of the Standard Oil Company (New Jersey), effective September 1, 1952. He is now in Venezuela reviewing the company's operations and will return to New York late this month to take up his new duties. Burrill will replace **Lloyd G. Smith,** vice president and director, who will devote his remaining time until retirement to refining problems of the company. A graduate of the Harvard Business School, Burrill joined Creole Petroleum in 1949. Prior to that time, he was with Standard Oil (New Jersey).

John C. Sample has been elected a member of the board of directors of the General Petroleum Corporation, it was announced at the company's head office in Los Angeles. For 11 years prior to 1949, Sample was with General Petroleum's marketing department, serving as vice president and director. He then went to New York as a director of the Standard-Vacuum Oil Company, returning to General Petroleum in May.

Frank Lindeman, Jr., and **Foster J. Schempf** were elected to the board of directors of Stanolind Oil and Gas Company at the board's regular meeting. Lindeman is manager of the producing department and Schempf is director of exploration. Election of the 2 raises to 11 the number of directors on the Stanolind board.

Lindeman joined Stanolind in 1933 upon his graduation from the Colorado School of Mines. He was named general superintendent in February, 1951, and became manager of the producing department on January 1, 1952.

Schempf is a graduate of the University of Wisconsin, where he received a BS degree in geology. Joining Stanolind in 1933 as a member of the geological staff at Tyler, Texas, he later served as district geologist at Tyler and Midland, Texas. He went to Tulsa on January 1, 1952, to assume his duties as director of exploration.

E. A. Austin, petroleum engineer for Continental Oil Company's southern region, has been promoted to the newly created position of assistant regional manger of production. Austin joined Continental in 1939 as a roustabout at Tepetate, Louisiana, and was promoted two years later to field engineer at Ville Platte, Louisiana. He served for five years in the Army during World War II, following which he became petroleum engineer for Conoco's Texas Gulf Coast district. He attended Haverford College, Haverford, Pennsylvania, and Colorado School of Mines.

Brown L. Meece has been named as assistant to the president of Sinclair Refining Company.

Meece, who is a vice president of Sinclair, is well known throughout the industry and particularly in the Middle West where he was vice president and manager of Sinclair's western sales division.

Prior to coming with Sinclair, Meece was vice president and general sales manager of Globe Oil and Refining Company of Chicago, Illinois.

Bud Flood, assistant coordinator of Imperial Oil Company's accident prevention division in Toronto, Canada on a recent visit to the company's Edmonton refinery. Flood also visited the fields in connection with accident prevention.

William H. Miller, assistant general manager of the Standard Oil Company (Indiana), has been elected to the Board of Trustees of Parsons College. A 1928 graduate and former athletic star at Parsons College, Miller joined Standard Oil in 1929. At present he is an executive in the reseller department, with headquarters in Chicago, Illinois.

E. H. (Buck) Weaver, manager of purchases for Union Oil Company, spoke to the Petroleum Equipment Salesmen's Association in Los Angeles, recently on "Relationship of the Purchasing Agent to the Salesman."

E. H. Weaver

Over 70 men attended the meeting and the following guests were welcomed by D. H. Greenwood, president of the association: Walter Boyd, Tidewater Oil; Charles Keeble, Union Pacific Railroad; C. S. Perkins, Union Oil; Emerson Plunkett, National Supply; G. E. Pitts, Republic Supply; Howard E. Baker, Howard E. Baker; Bill Runbeck, Guy Martin; N. D. Bertram, Parkhill Wade; Horace Caufield, Tube Sales; R. D. Reinke, Grinnell; Bill Halton, Howard Supply; John Buchanan, Buchanan and Price; Jack E. Fleischli, Chain Belt; Bob Benham, and Bill Smith, Los Angeles Automotive; John Mott, Barber Colman; W. K. Brownell, Gibbs and Hill; Hoyt Jones, Perry Kilsby; Jack Hulihan, and Bill Pickering, Bethlehem Supply, and Robert Becker, Union Oil.

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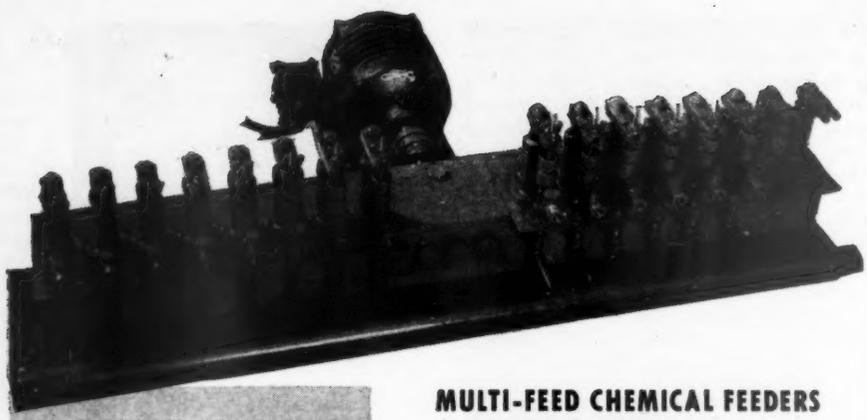

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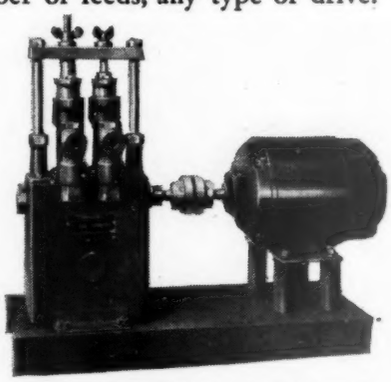

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R. A. Hunter has been appointed assistant to C. M. Gile, a vice president of Gulf Oil Corporation. In 1933 Hunter joined Gulf as a clerk at the Upper Darby, Pennsylvania, bulk station shortly after graduating from the University of Pennsylvania. In 1949 Gulf appointed him assistant director of supply, and he served in that position until a year ago when he was asked by the Government, for the second time, to serve as assistant director, supply and transportation division, Petroleum Administrator for Defense, Washington, D. C.

Harold M. Madsen has been appointed administrative assistant to the general manager of manufacturing of Standard Oil Company (Indiana), an additional position, at the general offices in Chicago, Illinois. His assignment will include study of organization plans, policies, methods, and procedures. Madsen joined Standard in 1928 at its Whiting refinery, where he has since worked in the engineering, projects, and industrial relations divisions.

Dr. Lal C. Verman, director, the Indian Standards Institution, New Delhi, India, has been reelected to a three-year term, effective immediately, as vice president of the International Organization for Standardization (ISO). **Willy Ruggaber,** chief engineer, Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, and president of the Swiss Association, was elected treasurer. He succeeds **Max Reichert,** director of the Belgium Standards Institution. Ruggaber will take office on January 1, 1953.

Lewis H. Bond, Jr.

Lewis H. Bond, Jr., petroleum engineer, has been named to the staff of the Fort Worth National Bank, with expansion of the bank's oil loan division. He had been with the Stanolind Oil and Gas Company since 1947. He began his career with Stanolind as a junior petroleum engineer in the company's East Texas area office at Greggton, Texas. In 1948, Bond was transferred to Stanolind's district office at Longview where he performed reservoir studies and computations. Transferred to the company's division office in Fort Worth in 1949, he was assigned to the reservoir engineering section. He was promoted in January, 1951, and became the head of the company's Fort Worth division proration section, a position he held until this month.

H. J. Struth, petroleum consultant, has established office headquarters in the Kirby Building, Dallas. He will specialize in economic research, the preparation of informational publications, and serve as advisory counsellor on matters pertaining to petroleum industry economics and fact-founded public relations.

During the last two years, Struth has been spending much of his time in South America, as economic consultant to the Venezuelan Government, in connection with petroleum developments in that country. He compiled the first annual report of the Venezuelan oil industry, Anuario Petrolero de Venezuela, which

H. J. Struth

was presented at the National Petroleum Convention, held in Caracas last fall.

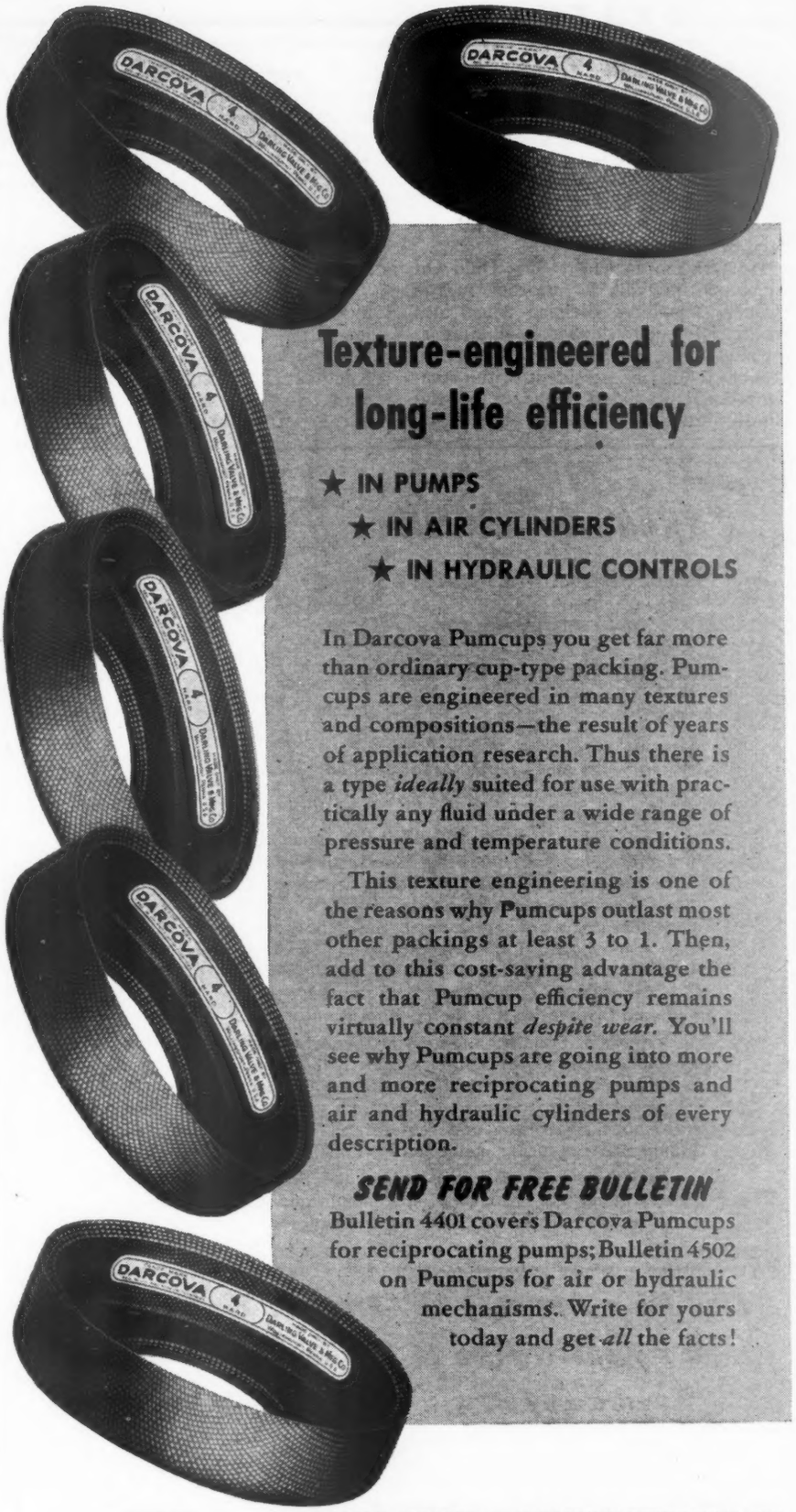
Prior to his foreign assignment, Struth spent a year in New York, as assistant director of public relations for The American Petroleum Institute and was formerly editor of *The Petroleum Data Book*. He was previously affiliated with The Texas Mid-Continent Oil and Gas Association, as economist and administrative assistant.

Bruce K. Brown, deputy administrator of the Petroleum Administration for Defense for the past 19 months, has been re-elected a director and president of Pan-Am Southern Corporation. Brown, who left the PAD post May 30, said **Roy J. Diwoky,** executive vice president who served as administrative head of the company during Brown's absence, would continue to hold the executive vice president positions.

Diwoky's two assistants have been given new positions in a re-arrangement of organizational assignments. **Sam H. Casey,** formerly assistant to the executive vice president, has been assigned to the newly created position of general mnager of purchase, and **Lyle R. Duty,** who was also an assistant to the executive vice president, has been assigned the new position of administrative assistant to the president.

Casey, who is a director of the company, will have both crude oil purchasing and materials and supplies purchases under his jurisdiction. He attended the University of Illinois and Milliken University.

Duty joined Pan-Am 16 months ago after having served with Standard Oil Company (Indiana) for 22 years. He attended the University of Iowa and LaCrosse (Wisconsin) State College.



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DEATHS

R. C. Gwilliam, vice president and manager of the Houston, Texas, division of The Ohio Oil Company, died at his home July 15, following a heart attack. Gwilliam entered the University of Utah in 1910. After two years of pre-law studies, he transferred to Cornell University where he received his L.B. degree in 1916.

He was employed by The Ohio Oil Company in 1930, as attorney in the Casper, Wyoming, division office, and was transferred to the Tulsa, Oklahoma, division office in 1932. June, 1937, he was elected a vice president of the company and appointed manager of the Houston division.

Mr. and Mrs. Clarence D. Holland were drowned when they were caught in an undertow while swimming in the surf at Savannah Beach, Georgia, June 27. Holland had been with The Youngstown Sheet and Tube Company more than 25 years, and at the time of his death was resident salesman at Charlotte, working out of Atlanta, Georgia, district sales office.

Vic Sanders, manager of industrial insulation sales, Pittsburgh Corning Corporation, died June 20 in Louisville, Kentucky, following a brief illness. Sanders had been associated with Pittsburgh Corning since 1944.

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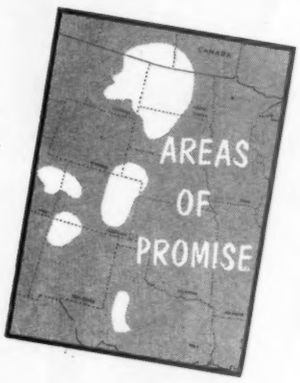

When we began a series of issues covering new areas of Oil Promise last February, the idea created great demand over night. Readers flooded us with requests for copies.

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Alan B. Wells, retired assistant treasurer and assistant secretary of Universal Atlas Cement Company, a subsidiary of United States Steel Corporation, with which he was connected for 43 years, died at his home in East Orange, New Jersey, on June 21. Wells began his business career in 1898 as a clerk for formative and subsidiary companies of U. S. Steel Corporation. He joined Universal Atlas in 1909.

William Luther Lewis, president of the Chicago Pneumatic Tool Company, New York, died June 28, in the Northern Westchester Hospital.

A native of Wales, Lewis was brought to this country as a boy and first worked in Bridgeport, Ohio, for a lumber company. Later he came to the attention of Charles M. Schwab, who aided his advancement. Lewis joined the Bethlehem Steel organization and rose to assistant controller. In 1930 he was elected vice president, secretary and treasurer of the Chicago Pneumatic Tool Company, and in 1946 he was elected president.

C. R. Skidmore, Texas and Louisiana drilling contractor, died July 13 in Midland, Texas. He was vice president of the Tri-State Drilling Company at Midland where he had lived nearly three years. He was formerly associated with the Peterson Drilling Company, residing in Lubbock, Texas, and Shreveport, Louisiana, during that time.

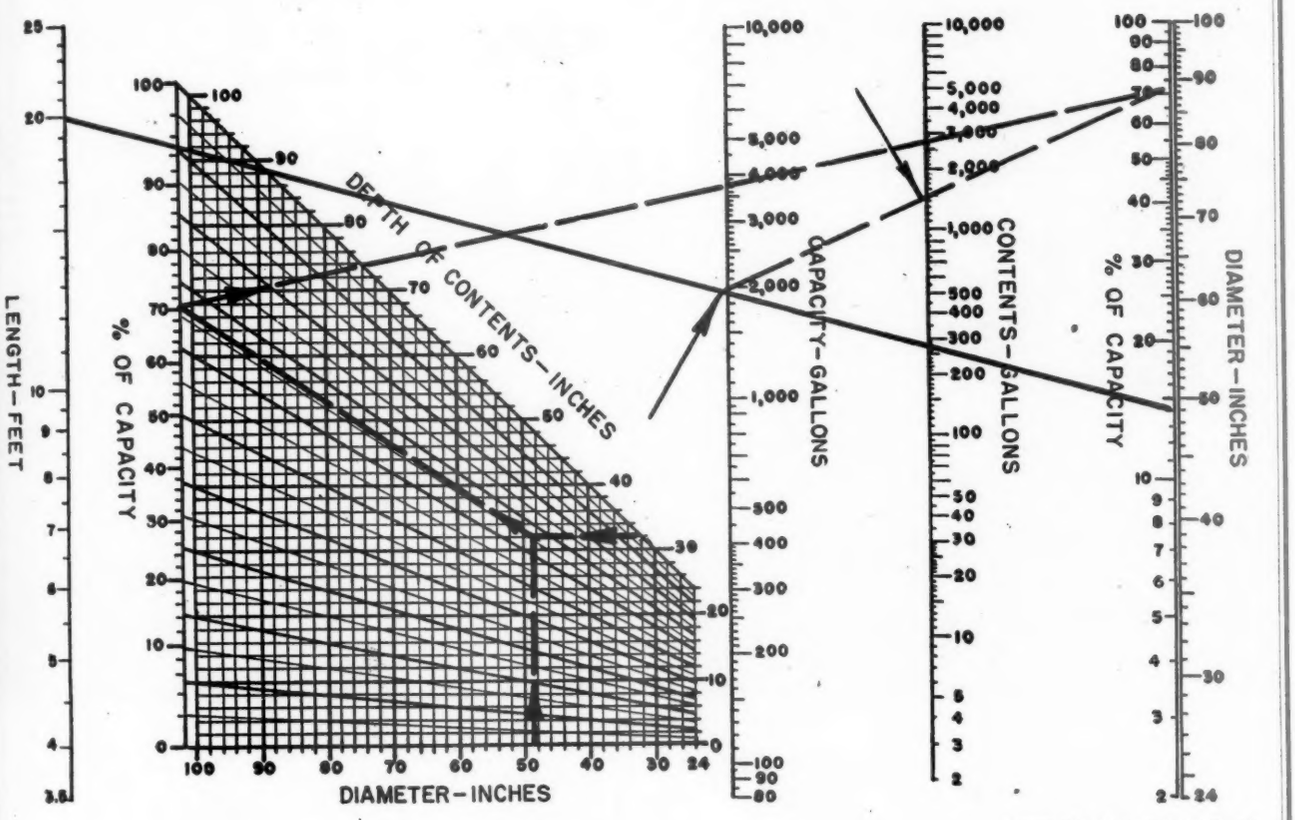
P. E. Thompson, 65, superintendent of the Lima, Ohio, division of The Ohio Oil Company's Pipe Line Department, died July 17 in Lima Memorial Hospital. He entered the hospital following a stroke, and suffered a similar attack the next morning.

Thompson was born in Clinton County, Pennsylvania. He began his pipe line career in 1906 with the Prairie Oil and Gas Company, and gained experience with other companies before joining The Ohio Oil Company on April 24, 1912, as assistant fireman at Bluffton, Indiana.

During the next 25 years, he served as engineer at Negley, Ohio, and Bluffton, Indiana. He was transferred at various times during this period to pipe line construction projects in Montana, Wyoming, Ohio, Indiana, Texas, Kentucky, and Utah. In 1937, he went to Lima as assistant superintendent of the Lima division, and was appointed division superintendent in 1938.

Roy T. Osborn for 24 years counsel of Sinclair Refining Company, died July 18 in San Antonio, Texas, after a long illness. Judge Osborn attended the University of Kansas, from which he was graduated in 1897, and in 1900 received his LLB. After approximately eight years as probate judge in Independence, Kansas, he joined the Sinclair Refining's legal department at Chicago in 1918, transferring to New York in 1924. He remained as counsel of Sinclair Refining until his retirement in 1942. He was a member of the API and served on the Institute's Industries Committee until his retirement.

Nomograph for Determination of Capacity and Contents of Horizontal Cylindrical Tanks



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Solid line: To determine capacity of a 48-in. diam tank by 20 ft long.
Broken line: To determine contents of the same tank when depth of contents is 32 in.

How to Use Chart

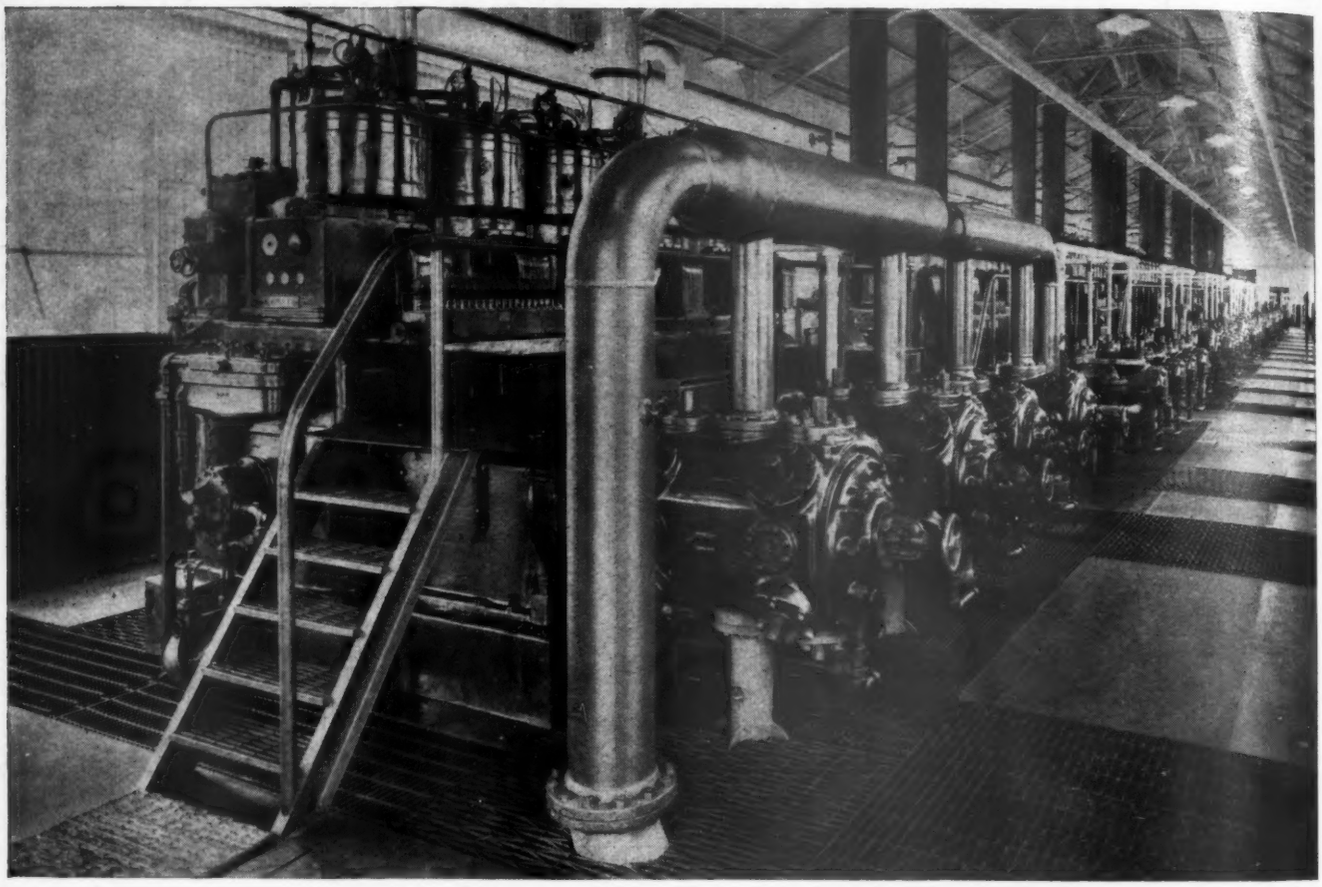
DETERMINATION of the capacity and contents of horizontal cylindrical tanks can be made on this chart in a matter of seconds. No calculations are necessary. All that's required is the length and diameter of the tank in question, and when partially filled, the depth of the contents.

Examples

To determine the capacity of a tank 48 in. in diameter by 20 ft long, find 20 ft on the scale at the far left and 48 in. on the scale at far right, and join with a ruled line. Correct capacity is then found where this line intersects the capacity scale, in this case, 1950 gal (plotted in solid line).

To determine the contents of this same tank when the depth of the contents is, say, 32 inches, locate this dimension and the diameter on the chart (broken line). Where these lines intersect follow the line upward to the left. The scale indicates the contents to be 70 per cent of capacity. Locate this figure on the per cent of capacity scale at right and rule a line back to the original 1950 figure on the capacity scale. The correct content figure is then found where this line intersects the contents scale —about 1400 gal.—*Courtesy Armstrong Trap Magazine.*

a mere .013" of power cylinder wear after 10 years' full-load operation



...that's Clark quality for you!

Clark "Right Angle" Compressors set remarkable record in Lion Oil Company operated Shuler Unit Natural Gasoline and Pressure Maintenance Plant

Power cylinder wear of less than .00125" per year after initial break-in! Total average wear of .013" per cylinder for the whole 10-year period!

. . . that's the remarkable record of six Clark RA-6, 600 bhp Right Angle, Gas-Engine-Driven Compressors operating continuously at full load since 1941 in Shuler Unit, Arkansas natural gasoline and pressure maintenance plant which is operated by Lion Oil Company.

But that's not all that's remarkable about this installation. The original power piston rings were in service for 8½ of those years before needing replacement.

Two other Clark RA-6 units operating since 1943 and 1948 respectively, are showing the same unusual resistance to wear . . . the same extremely low maintenance.

That's Clark quality and durability for you!

There's a BIG Difference in...

CLARK compressors

CLARK BROS. CO. • OLEAN, N. Y.
Division of Dresser Operations, Inc.
Offices in Principal Cities throughout the World

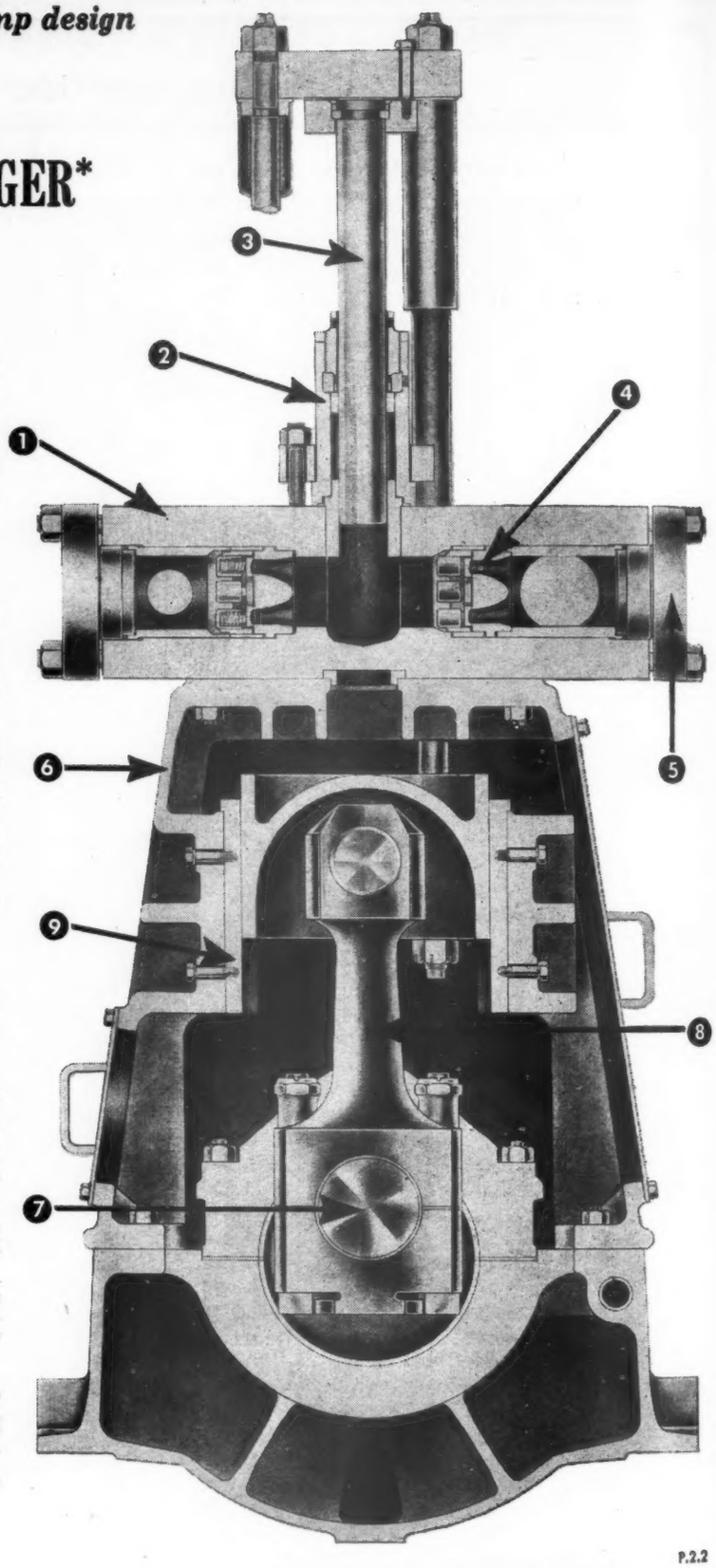
PRESSURE CONVERSION TABLE

Water, in.	Mercury, in.	Mercury, in.	Lb. per sq. in.	Water, ft.	Lb. per sq. in.	Water, ft.	Lb. per sq. in.	Water, ft.
1.0	.074	.2	.098	.23	20	46.2	335	773.5
1.5	.111	.4	.196	.45	25	57.7	340	785.0
2.0	.148	.6	.294	.68	30	69.3	345	796.6
2.5	.184	.8	.391	.90	35	80.8	350	808.1
3.0	.221	1.0	.489	1.13	40	92.4	355	819.7
3.5	.258	1.5	.734	1.69	45	103.9	360	831.2
4.0	.295	2.0	.979	2.26	50	115.4	365	842.8
4.5	.332	2.5	1.223	2.82	55	127.0	370	854.3
5.0	.369	3.0	1.468	3.39	60	138.5	375	865.8
5.5	.406	3.5	1.713	3.95	65	150.1	380	877.4
6.0	.443	4.0	1.957	4.52	70	161.6	385	888.9
6.5	.479	4.5	2.202	5.08	75	173.2	390	900.5
7.0	.516	5.0	2.447	5.65	80	184.7	395	912.0
7.5	.553	5.5	2.692	6.21	85	196.3	400	923.6
8.0	.590	6.0	2.936	6.78	90	207.8	405	935.1
8.5	.627	6.5	3.181	7.34	95	219.3	410	946.7
9.0	.664	7.0	3.426	7.91	100	230.9	415	958.2
9.5	.701	7.5	3.670	8.47	105	242.4	420	969.7
10.0	.738	8.0	3.915	9.04	110	254.0	425	981.3
10.5	.774	8.5	4.160	9.60	115	265.5	430	992.8
11.0	.811	9.0	4.404	10.17	120	277.1	435	1004.4
11.5	.848	9.5	4.649	10.73	125	288.6	440	1015.9
12.0	.885	10.0	4.894	11.30	130	300.2	445	1027.5
12.5	.922	10.5	5.138	11.86	135	311.7	450	1039.0
13.0	.959	11.0	5.383	12.43	140	323.2	455	1050.6
13.5	.996	11.5	5.628	12.99	145	334.8	460	1062.1
14.0	1.033	12.0	5.872	13.56	150	346.3	465	1073.6
14.5	1.069	12.5	6.117	14.12	155	357.9	470	1085.2
15.0	1.106	13.0	6.362	14.69	160	369.4	475	1096.7
15.5	1.143	13.5	6.606	15.25	165	381.0	480	1108.3
16.0	1.180	14.0	6.851	15.82	170	392.5	485	1119.8
16.5	1.217	14.5	7.096	16.38	175	404.1	490	1131.4
17.0	1.254	15.0	7.341	16.95	180	415.6	495	1142.9
17.5	1.291	15.5	7.585	17.51	185	427.2	500	1154.5
18.0	1.328	16.0	7.830	18.08	190	438.7	510	1177.5
18.5	1.364	16.5	8.075	18.64	195	450.2	520	1200.6
19.0	1.401	17.0	8.319	19.21	200	461.8	530	1223.7
19.5	1.438	17.5	8.564	19.77	205	473.3	540	1246.8
20.0	1.475	18.0	8.809	20.34	210	484.9	550	1269.9
20.5	1.512	18.5	9.053	20.90	215	496.4	560	1293.0
21.0	1.549	19.0	9.298	21.47	220	508.0	570	1316.1
21.5	1.586	19.5	9.543	22.03	225	519.5	580	1339.2
22.0	1.623	20.0	9.787	22.60	230	531.1	590	1362.3
22.5	1.659	20.5	10.032	23.16	235	542.6	600	1385.4
23.0	1.696	21.0	10.277	23.73	240	554.1	610	1408.4
23.5	1.733	21.5	10.521	24.29	245	565.7	620	1431.5
24.0	1.770	22.0	10.766	24.86	250	577.2	630	1454.6
24.5	1.807	22.5	11.011	25.42	255	588.8	640	1477.7
25.0	1.844	23.0	11.255	25.99	260	600.3	650	1500.8
25.5	1.881	23.5	11.500	26.55	265	611.9	660	1523.9
26.0	1.918	24.0	11.745	27.12	270	623.4	670	1547.0
26.5	1.954	24.5	11.989	27.68	275	635.0	680	1570.1
27.0	1.991	25.0	12.234	28.25	280	646.5	690	1593.2
27.5	2.028	25.5	12.479	28.81	285	658.0	700	1616.2
28.0	2.065	26.0	12.724	29.38	290	669.6	710	1639.3
28.5	2.102	26.5	12.968	29.94	295	681.1	720	1662.4
29.0	2.139	27.0	13.213	30.51	300	692.7	730	1685.5
29.5	2.176	27.5	13.458	31.07	305	704.2	740	1708.6
30.0	2.213	28.0	13.702	31.64	310	715.8	750	1731.7
30.5	2.249	28.5	13.947	32.20	315	727.3	760	1754.8
31.0	2.286	29.0	14.192	32.77	320	738.9	770	1777.9
31.5	2.323	29.5	14.436	33.33	325	750.4	780	1801.0
32.0	2.360	30.0	14.681	33.90	330	761.9	790	1824.0

The inside story of a new power-pump design

THE WORTHINGTON HEAVY-DUTY MULTI-PLUNGER* VERTICAL POWER PUMP

To users of Worthington pumps, "heavy-duty construction" is almost taken for granted. But when Worthington engineers make a special effort to put *extra* ruggedness into a pump, you have something comparable to this Worthington Multi-Plunger Power Pump. Study the features and see for yourself!



P.2.2

ON THE LIQUID END

1. LIQUID CYLINDER—made of forged steel with large fluid passageways bored from solid forgings for maximum strength.

2. STUFFING BOXES—forged-steel barrels, bolted directly to cylinder with extra-deep boxes that permit maximum interchange of plunger sizes.

3. PLUNGERS—made from hardened and ground alloy steel or any other suitable metal. Solid ceramic plungers can be furnished for corrosive applications.

4. VALVE SERVICE—stainless-steel, heat-treated valves and valve seats. High-strength valve springs and bolted valve-hole covers.

5. INDIVIDUAL VALVE HOLE COVERS—one for each valve, permits quick and easy access.

ON THE POWER END

6. CAST-IRON FRAME—totally enclosed, with design that permits torque to be applied near foundation. All bearing surfaces and running parts pressure lubricated.

7. ONE-PIECE STEEL CRANKSHAFT—one-piece forged steel, accurately turned and ground to size. Heavy sections for minimum shaft deflection when loaded.

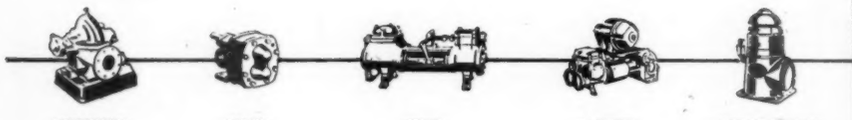
8. CONNECTING ROD—marine-type, forged-steel, with steel-backed, babbitt-lined crankpin bearings and solid bronze crosshead pin bearings.

9. CROSSHEAD CRADLE LINERS—solid cast iron with bronze liner shim adjustable to permit careful alignment.

10. BRONZE-SHELL MAIN BEARINGS†—two-piece bronze shell design babbitt-lined with large bearing surface for longest-life. Precision made for trouble free operation.

If your application calls for a power pump of this size, *or any other size*, write, stating specific requirements, to Worthington Corporation, Reciprocating Pump Division, Harrison, New Jersey.

*available in 3, 5 or 7 plunger arrangements (300, 500, 700 hp)
†not shown in drawing



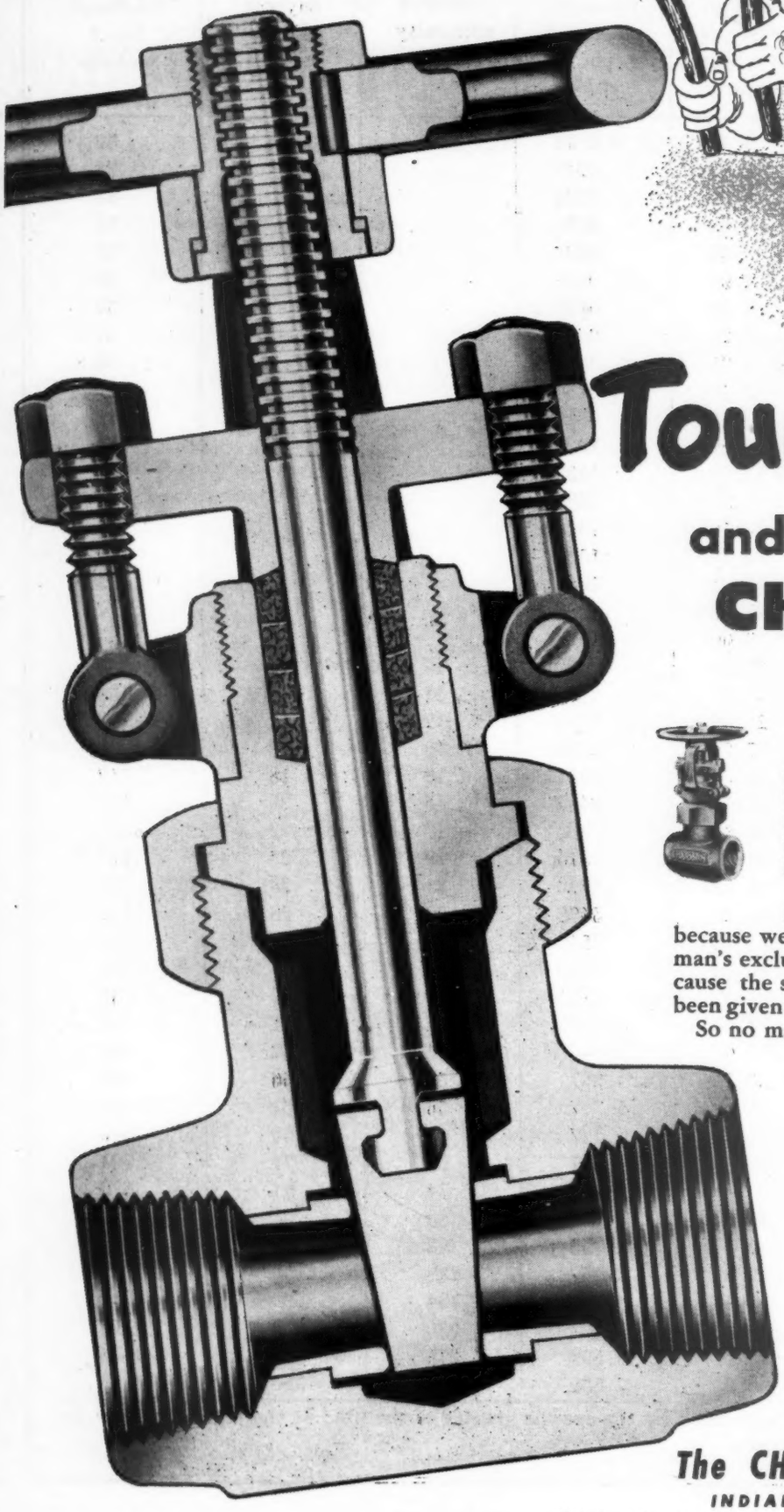
The World's Broadest Line Assures You the Right Pump for Every Job

WORTHINGTON
Power Pumps

VISCOSITY CONVERSION FACTORS

Saybolt universal seconds	Engler degrees	Absolute viscosity, centipoises,[1] also relative viscosity	Kinematic viscosity, poises per g. per cc, n/d	Redwood admiralty seconds	Saybolt Furol seconds	Redwood No. 1 seconds
32	1.08	1.41	0.0141			30
34	1.14	2.19	.0219			31
36	1.19	2.92	.0292			33
38	1.25	3.63	.0363			34
40	1.31	4.30	.0430			36
42	1.37	4.95	.0495			38
44	1.43	5.59	.0559			39
46	1.48	6.21	.0621			41
48	1.53	6.81	.0681			43
50	1.58	7.40	.0740			44
55	1.73	8.83	.0883			48
60	1.88	10.20	.1020			53
65	2.03	11.53	.1153			57
70	2.17	12.83	.1283			61
75	2.31	14.10	.1410			65
80	2.46	15.35	.1535			69
85	2.59	16.58	.1658			73
90	2.74	17.80	.1780			77
95	2.88	19.00	.1900			81
100	3.02	20.20	.2020	10	15	86
110	3.31	22.56	.2256	11	16	94
120	3.60	24.90	.2490	12	17	102
130	3.69	27.21	.2721	13	18	111
140	4.19	29.51	.2951	13	18	119
160	4.77	34.07	.3407	15	20	136
180	5.35	38.60	.3860	17	22	153
200	5.92	43.10	.4310	19	23	170
225	6.64	48.70	.4870	21	26	191
250	7.35	54.28	.5428	23	28	212
300	8.79	65.40	.6540	28	32	254
350	10.25	76.49	.7649	32	37	296
400	11.68	87.55	.8755	37	42	338
450	13 00	98.60	.9860	42	47	380
500	14.00	109.6	1.096	46	52	422
550	16.00	120.7	1.207	50	56	465
600	17.00	131.7	1.317	55	61	507
650	19.00	142.7	1.427	60	66	549
700	20.00	153.7	1.537	64	71	591
800	23 00	175.8	1.758	74	81	676
900	26.00	197.8	1.978	83	91	760
1000	29.00	219.8	2.198	92	101	845
1500	43 00	329.9	3.299	138	150	1267
2000	58.00	439 9	4.399	184	200	1690
2500	72 00	549.9	5.499	230	250	2112
3000	87 00	659.9	6.599	276	300	2535
3500	101 00	769 9	7 699	322	350	2957

[1]Values in this column must be multiplied by the specific gravity of the fluid at the temperature of the measurement to complete the conversion.



Tough Guy!

and his number is CHAPMAN List 960

Tough — that's the word for this small Chapman Gate Valve with the forged steel body and yoke. For no matter what job you put it on, within its remarkable capacity-range, you'll find it *tougher than the toughest conditions!*

That's right, *tougher* . . . because seat rings are hardened stainless steel . . . because wedge-faces are *superhardened* by Chapman's exclusive Malcomizing Process . . . and because the stem and wedge gate connection has been given extra strength to meet any extra stress.

So no matter what your job for small forged steel gate valves, Chapman's List 960 is the one you can bet on to "lick all comers." You can get it in sizes from ½" to 2" . . . equipped with rising stem, either with yoke as shown, or with inside screw. Bonnet joints are gasketed or metal-to-metal. Pressure range: 2,000 lb. at 100° F., to 380 lb. at 1,000° F. For higher pressures, specify List 990. Write for Catalog No. 10.

The CHAPMAN Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS

STORAGE CAPACITY OF GAS SANDS, THOUSAND CU. FT. PER ACRE FT.
(Temperature 60 deg. fahr.)

Bottom hole pressure, lb. per sq. in. gauge	Percent porosity								
	10	12	14	16	18	20	22	24	26
10	7.313	8.776	10.24	11.70	13.16	14.63	16.09	17.55	19.01
20	10.27	12.32	14.38	16.43	18.49	20.54	22.60	24.65	26.70
30	13.23	15.87	18.52	21.16	23.81	26.46	29.10	31.75	34.39
40	16.18	19.42	22.66	25.90	29.13	32.37	35.61	38.84	42.08
50	19.14	22.97	26.80	30.63	34.46	38.28	42.11	45.94	49.77
60	22.10	26.52	30.94	35.36	39.78	44.20	48.62	53.04	57.46
70	25.06	30.07	35.08	40.09	45.10	50.11	55.12	60.14	65.15
80	28.01	33.62	39.22	44.82	50.42	56.03	61.63	67.23	72.84
90	30.97	37.17	43.36	49.55	55.75	61.94	68.14	74.33	80.52
100	33.93	40.71	47.50	54.29	61.07	67.86	74.64	81.43	88.21
110	36.89	44.26	51.64	59.02	66.39	73.77	81.15	88.53	95.90
120	39.84	47.81	55.78	63.75	71.72	79.69	87.65	95.62	103.59
130	42.80	51.36	59.92	68.48	77.04	85.60	94.16	102.72	111.28
140	45.76	54.91	64.06	73.21	82.36	91.51	100.67	109.82	118.97
150	48.71	58.46	68.20	77.94	87.69	97.43	107.17	116.91	126.66
160	51.67	62.01	72.34	82.67	93.01	103.34	113.68	124.01	134.35
170	54.63	65.55	76.48	87.41	98.33	109.26	120.18	131.11	142.04
180	57.59	69.10	80.62	92.14	103.66	115.17	126.69	138.21	149.72
190	60.54	72.65	84.76	96.87	108.98	121.09	133.20	145.30	157.41
200	63.50	76.20	88.90	101.60	114.30	127.00	139.70	152.40	165.10
210	66.46	79.75	93.04	106.33	119.62	132.92	146.21	159.50	172.79
220	69.42	83.30	97.18	111.06	124.95	138.83	152.71	166.60	180.48
230	72.37	86.85	101.32	115.80	130.27	144.74	159.22	173.69	188.17
240	75.33	90.40	105.46	120.53	135.59	150.66	165.72	180.79	195.86
250	78.29	93.94	109.60	125.26	140.92	156.57	172.23	187.89	203.55
260	81.24	97.49	113.74	129.99	146.24	162.49	178.74	194.99	211.23
270	84.20	101.04	117.88	134.72	151.56	168.40	185.24	202.08	218.92
280	87.16	104.59	122.02	139.45	156.89	174.32	191.75	209.18	226.61
290	90.12	108.14	126.16	144.19	162.21	180.23	198.25	216.28	234.30
300	93.07	111.68	130.30	148.92	167.53	186.15	204.76	223.37	241.99
310	96.03	115.24	134.44	153.65	172.85	192.06	211.27	230.47	249.68
320	98.99	118.78	138.58	158.38	178.18	197.97	217.77	237.57	257.37
330	101.94	122.33	142.72	163.11	183.50	203.89	224.28	244.67	265.06
340	104.90	125.88	146.86	167.84	188.82	209.80	230.78	251.76	272.74
350	107.86	129.43	151.00	172.57	194.15	215.72	237.29	258.86	280.43
360	110.82	132.98	155.14	177.31	199.47	221.63	243.80	265.96	288.12
370	113.77	136.53	159.28	182.04	204.79	227.55	250.30	273.06	295.81
380	116.73	140.08	163.42	186.77	210.12	233.46	256.81	280.15	303.50
390	119.69	143.63	167.56	191.50	215.44	239.38	263.31	287.25	311.19
400	122.65	147.17	171.70	196.23	220.76	245.29	269.82	294.35	318.88
410	125.60	150.72	175.84	200.96	226.08	251.20	276.33	301.45	326.57
420	128.56	154.27	179.98	205.70	231.41	257.12	282.83	308.54	334.26
430	131.52	157.82	184.12	210.43	236.73	263.03	289.34	315.64	341.94
440	134.47	161.37	188.26	215.16	242.05	268.95	295.84	322.74	349.63
450	137.43	164.92	192.40	219.89	247.38	274.86	302.35	329.84	357.32
460	140.39	168.47	196.54	224.62	252.70	280.78	308.85	336.93	365.01
470	143.35	172.01	200.68	229.35	258.02	286.69	315.36	344.03	372.70
480	146.30	175.56	204.82	234.08	263.35	292.61	321.87	351.13	380.39
490	149.26	179.11	208.96	238.82	268.67	298.52	328.37	358.22	388.08
500	152.22	182.66	213.10	243.55	273.99	304.44	334.88	365.32	395.77
550	167.00	200.40	233.81	267.21	300.61	334.01	367.41	400.81	434.21
600	181.79	218.15	254.51	290.86	327.22	363.58	399.94	436.30	472.65
650	196.58	235.89	275.21	314.52	353.84	393.15	432.47	471.78	511.10
700	211.36	253.63	295.91	338.18	380.45	422.72	465.00	507.27	549.54
750	226.15	271.38	316.61	361.84	407.07	452.30	497.53	542.76	587.99
800	240.93	289.12	337.31	385.50	433.68	481.87	530.06	578.24	626.43
850	255.72	306.86	358.01	409.15	460.30	511.44	562.59	613.73	664.87
900	270.51	324.61	378.71	432.81	486.91	541.01	595.11	649.22	703.32
950	285.29	342.35	399.41	456.47	513.53	570.59	627.64	684.70	741.76
1000	300.08	360.09	420.11	480.13	540.14	600.16	660.17	720.19	780.21

LAUGH with BARNEY

He had just given his wife a new skunk coat.

"I can't see," she remarked, "how such a nice coat could come from such a foul-smelling beast."

"Well," he replied, "I don't care about thanks, but I do insist upon respect."

* * *

"Have you seen Faith's new evening gown?"

"No, what does it look like?"

"Well, in places, it looks quite a bit like Faith."

* * *

There was a broken fence between heaven and hell. The devil sent a note to the angels saying: "On advice of legal counsel, am pleased to inform you that the repairs are entirely your responsibility." The heavenly administration replied: "Having no legal counsel to advise us, we have decided to repair the fence."

* * *

Father: "Mary, who was that man I saw you kissing last night?"

Mary: "What time was it?"

* * *

A man never gets so old that he isn't in there pinching.

* * *

When a woman says: "I'll be ready in a minute," you can be sure of one thing—she speaks English.

A little boy of six was invited to lunch in a friend's home. As soon as they were all seated at the table, the food was served. The little visitor was frankly puzzled. With all the forthright honesty of a child he asked his host:

"Don't you say any prayers before you eat?"

"No," mumbled the host, uncomfortable over the boy's inquiry, "we don't take time for that."

The little visitor thought silently for a moment, and then he said: "You're just like my dog! You start right in!"

* * *

Why, honey! You look positively beautiful—oh, no wonder—you're not 'honey'!"

* * *

He who laughs last has found a double meaning.

* * *

One woman to another: "Why don't you go to him in a perfectly straightforward way and lie about the whole thing?"

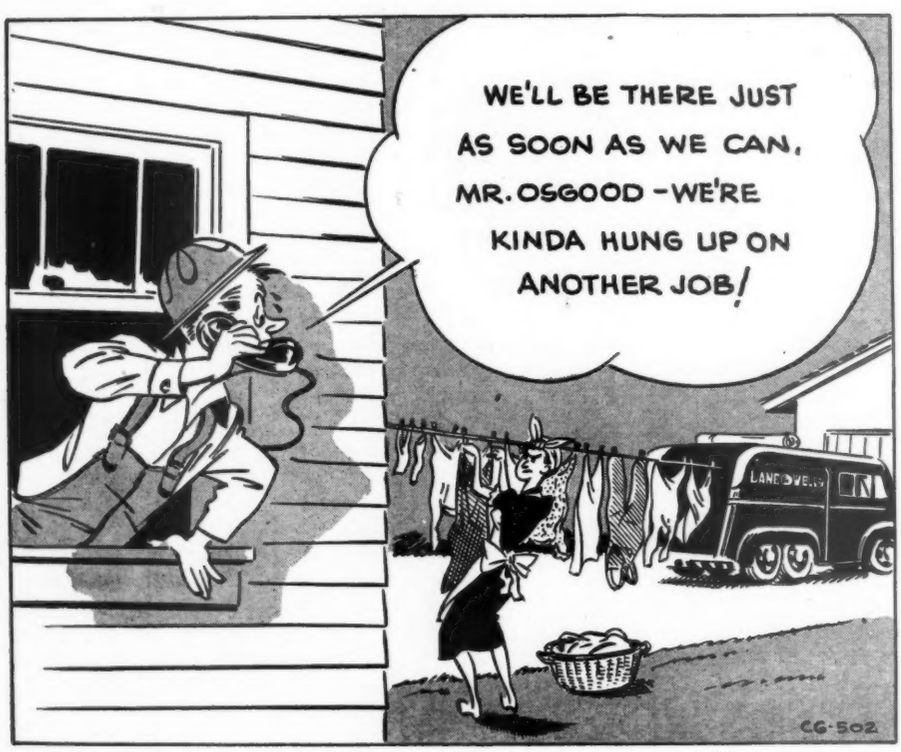
* * *

Protect the birds: The dove brings peace and the stork brings exemptions.

* * *

Sea legs: What many yachtsmen use their binoculars for.

Sloop: Sound heard frequently during the soup course.



He took her hand in his and gazed proudly at the engagement ring he had placed on her finger only three days before.

"Did your friends admire it?" he asked, tenderly.

"They did more than that," she said. "Two of them recognized it."

* * *

Have you heard about the guy who finally got rid of B.O. and then found out people did not like him anyway?

* * *

The despondent old gentleman emerged from his club and climbed into his luxurious limousine.

"Where to, sir?" asked his driver respectfully.

"Drive off the cliff, James," he answered. "I'm committing suicide."

* * *

Sambo and Rastus were having their supper. A large fly was buzzing around Sambo and Rastus endeavored to shoo it away from his friend.

"What sort of fly am dat?" asked Sambo.

"Dat's a hoss-fly," replied Rastus. "Dey buzzes around jackasses mos'tly."

"Is you inferring Ah's a jackass?"

"Ah ain't inferrin' nothin'," replied Rastus, "but you can't fool dem hoss flies."

* * *

"Won't you join me in a cup of coffee?"

"You get in first."

* * *

"What is a flood?" the teacher asked as her pupils' brows formed ridges.

"I know," said Ray, the number one boy. "It's a river too big for its bridges."

* * *

Very late one night two chaps who had been imbibing too freely were sitting on the pavement with their feet in the gutter. One was heard to say to the other, "What does your wife say when you stay out like this?"

"Haven't got a wife," the other replied.

"Then why do you stay out late like this?"

* * *

A western sheriff confiscated a bunch of slot machines on the basis of a law banning the use of steel traps for catching dumb animals.

* * *

"Does your wife ever pay you any compliments?" asked the curious bachelor.

"Only in the winter," was the nonchalant answer.

"In the winter! How do you mean?"

"When the fire gets low she says, 'Alexander, the grate'!"

* * *

The hunter's bird dog came to a point looking straight at a stranger. The hunter looked all around, but couldn't see a single bird. Finally he said to the stranger: "That's odd. My dog never did that before."

"Perhaps I can explain," said the stranger. "My name is Partridge."

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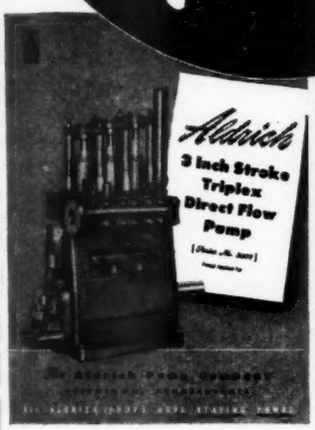

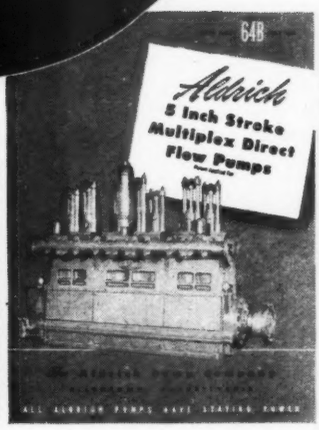

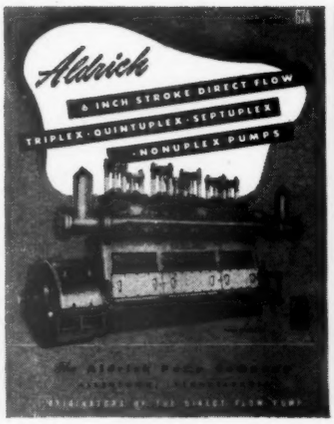

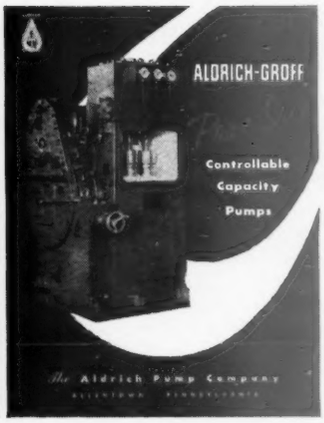

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OIL and GAS TRADE NEWS

Bromiley Represents Manzel

Manzel, manufacturers of force feed lubricators and chemicals feeders, is now represented in the Oklahoma-Kansas area by Edward C. Bromiley, of Tulsa. Bromiley has been associated with the oil industry for 20 years, in research, engineering, and sales for a number of prominent refiners and equipment manufacturers. Manzel home offices are at 315 Babcock Street, Buffalo 10, New York.

E. C. Bromiley

Beckman Opens Synchro Plant In Pasadena, California

Beckman Instruments, Inc., South Pasadena, California, announces the opening of a large new plant devoted exclusively to the manufacture of synchros and associated components. The new plant, just completed and specially-designed to house synchro operations, is entirely air-conditioned and is equipped with special electrostatic dust filters to permit highest-precision manufacturing techniques.

Cameron Iron Works Moves New York Export Office

The Export Division Offices of Cameron Iron Works have been moved from 74 Trinity Place to 7912 Empire State Building, 350 Fifth Avenue, New York City. D. C. Washburn, who has been a member of the Cameron Export Division for many years, has been promoted to the position of assistant sales manager, export division.

Harnischfeger Opens New Diesel Engine Plant

Harnischfeger Corporation officially opened its new diesel engine division in Crystal Lake, Illinois, recently, bringing to nine the number of P&H plants now in operation. A large number of guests attended the cornerstone-laying ceremony which was begun with a welcome by Karl P. Schoeppner, general manager of the diesel engine division. Keynote address was delivered by Walter Harnischfeger, president, in which he reviewed the 68-year history of the company and the development of its products, which include diesel engines, power shovels, truck cranes, etc. Henry Harnischfeger, executive vice president, and Fred Salditt, vice president, also addressed the meeting.

Aboard the American Export Lines S. S. Independence are Mr. and Mrs. Frank L. LeBus, Sr., president, LeBus International Engineers, Ltd., Wichita Falls, Texas, and chairman of board, LeBus Rotary Tool Works, Longview, Texas They sailed from New York, June 11, on a two-month tour of Europe at which time he plans to establish European outlets for all LeBus products.

National Supply Store Open

The National Supply Company has opened an oil and gas well supply store at Renovo, Pennsylvania, to better serve gas well drillers and producers in the Renovo and Leidy fields, Clinton County. J. Foy Love, formerly at Princeton, Indiana, has been named manager. C. W. Raabe and Edward Whiteman are fields salesmen and Paul N. Ballinger is floor clerk. About 98 strings of tools are now operating in the county. A fifth rotary rig, and Ideal 75 rig, is expected to go into operation soon.

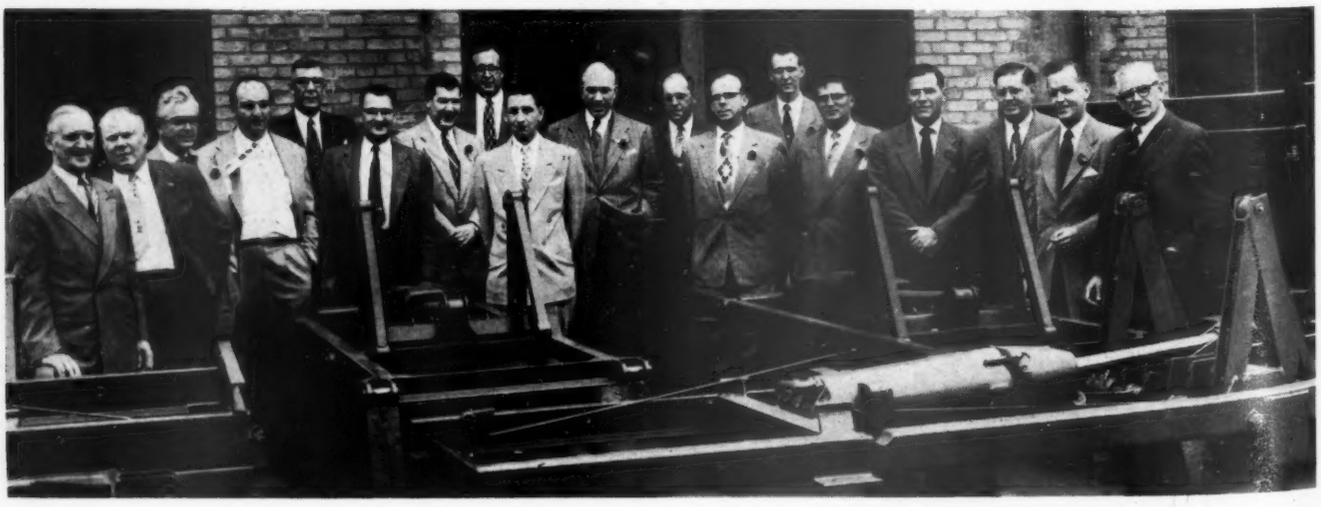
Paris Is Distributor For Gorman-Rupp Company

Henry H. Paris Distributor, Inc., Houston, Texas, has been named as Mid-Continent and Gulf Coast oilfield representative for Gorman-Rupp pumps and parts. By this appointment, Paris and his associates establish a Gorman-Rupp oilfield warehouse service. They succeed the late Tom L. Turner. All orders, inquiries and business routine relating to Gorman-Rupp product should be directed to Henry H. Paris Distributor, Inc.

Diesel Engine Course Held At University of Edmonton

The National Supply Company is participating in a diesel engine course being conducted by the department of extension, University of Alberta, at Edmonton, Alberta, Canada. The course was arranged at the request of the Western Canada Petroleum Association and the Canadian Association of Oilwell Drilling Contractors. Its purpose is to train oil industry personnel in the proper installation, operation, and maintenance of diesel engines.

St. Paul Hydraulic Hoist announced a new line of St. Paul bodies and hoists at a district manager's sales conference in Minneapolis, Minnesota recently. Attending the meeting were: William Lingner, William Cochrane, Harry Blake, Werner Toensing, John Record, Arthur Dries, Gar Wood Industries, Inc.; Frank Hasselman, Mark Sheppard, Harold H. Hippler, and Edward B. Hill, Gar Wood; Edward Curry, George Bachmann, W. C. Schultz, Gar Wood; Leo Brown, J. T. Conway, Howard Kenyon, Andrews Agency, Inc.; William Keeton, and Colonel E. A. Olding, G. H. Olding & Sons (PTY) Ltd.—Australia, Australian Gar Wood distributor. The meeting was conducted by W. F. Keeton, sales manager.



Lufkin Foundry Celebrates Its 50th Anniversary

Lufkin Foundry and Machine Company, one of the largest manufacturers of oil field equipment in the South, is celebrating its 50th anniversary this year. A special Golden Anniversary edition of the company's publication, The Lufkin Line, released recently, cites the history of the enterprise.

Cudlipp Little Trout

Besides its pumping units and other oil field equipment, the company produces truck trailers, commercial reduction gears and commercial castings. The story begins back in 1902 when five men —F. Kavanaugh, F. Kavanaugh, Jr., J. H. Kurth, Sr., S. W. Henderson, Sr., and Eli Wiener—formed a company that was to repair sawmill machinery.

The late W. C. Trout, who molded and shaped the policies of this company for many years, came to Lufkin in 1905. He recognized the industrial possibilities afforded by the small town of Lufkin. The little repair shop expanded, and instead of repairing machinery, the company began to manufacture sawmills. By 1906, the first Lufkin-equipped sawmill was in operation in southern Arkansas.

Lufkin Foundry then turned its attention to the newly discovered oil fields in South and East Texas. W. C. Trout found that little or no improvement had been made on the method by which oil was lifted to the surface since the beginning of the industry. Immediately the Lufkin Foundry began to pioneer and develop the application of reduction gears to oil well pumping. In 1923, the first geared Lufkin pumping unit was installed at Goose Creek. In 1929, Lufkin changed from the worm gear to the herringbone gear, and in 1931, the first twin crank pumping unit was produced. This is still the standard design for their modern unit. In 1939, the company purchased the Martin Wagon Company, and from the old eight-wheel wagon being produced by this firm, the company has progressed into the field of truck-trailers.

The new gray iron foundry, one of the dreams of progress of Trout, was officially opened April 11, 1947. Thirteen days later, the president of Lufkin Foundry died.

At the annual meeting of the board of directors in January, 1948, Walter W. Trout, eldest son of the late W. C. Trout, was named president.

Other officers of Lufkin Foundry are W. W. Trout, president; J. H. Kurth, Jr., Houston, vice president; A. E. Cudlipp, L. A. Little, and E. P. Trout, vice presidents; M. L. Wilkinson, secretary; and E. H. Bounds, treasurer.

Seventy-Five Years at Axelson is the combined service record of J. C. Axelson, president and general manager of the company and Bill Goertz, California sales manager of Axelson Petroleum Equipment Division shown above receiving 25-year service award. He is the 73rd man to receive the diamond service pin. This year marks J. C. Axelson's 51st year of active association with the company.

Kaylo Agents Appointed

Allied Services, Inc., Charleston, West Virginia, have been appointed distributor-applicator for Kaylo heat insulation by Owens-Illinois Glass Company. Allied Services officers are Conrad L. Wiegers, president and general manager; William D. Parks and L. S. Pennington, sales engineers.

The Homestead Insulation Company, Hartford, Connecticut, has been appointed distributor-applicator for Kaylo heat insulation in that area.

Childers Agents Named

The Childers Manufacturing Company of Houston, Texas, has announced the appointment of new sales representatives in Milwaukee, Wisconsin, and Cincinnati, Ohio, for Childers Corrugated aluminum jacketing. The Fred W. Koester Company, 743 North 4th Street, Milwaukee, has been appointed to handle sales to industrial plants in the Milwaukee area. The Jarvis Equipment Company, P. O. Box 33, Station D, Cincinnati, has been appointed to handle sales of Childers jacketing to industry in that area. Northern Heating and Insulating Reg'd, Arvida, Quebec, is new sales representative for Childers aluminum jacketing in the province of Quebec. The organization is headed by A. G. Joyce.

Instrument Show Planned

More than 10,000 engineers will go to Cleveland, Ohio, during September 8-12, 1952, for the Seventh National Instrument Conference and Exhibit sponsored by the Instrument Society of America. This will be the largest conference and exhibit, covering instruments and devices for measurement, inspection, testing, and automatic control, ever held in the United States. In addition to the 178 commercial exhibitors, the U. S. Navy, National Bureau of Standards, A & M College of Texas, U. S. Geological Survey, National Advisory Committee for Aeronautics, and Case Institute of Technology will have displays.

Eastman Oil Well Survey Company held a gala barbecue recently in celebration of the company's new office building in Lafayette, Louisiana. H. John Eastman, president, made a welcome speech to the approximately 475 oil industry leaders present. Shown at the celebration are: Windy Cook, Gulf Coast division manager, standing, stops to greet Shell Oil personnel, Henry Lay, Leland Milstead, D. J. Wilson, Dick Myers, and C. R. Schriber. Waiting for the dinner bell to ring are: Basil Phillibar, Eastman, Max Clayton, Cook, and Bob Reeves.

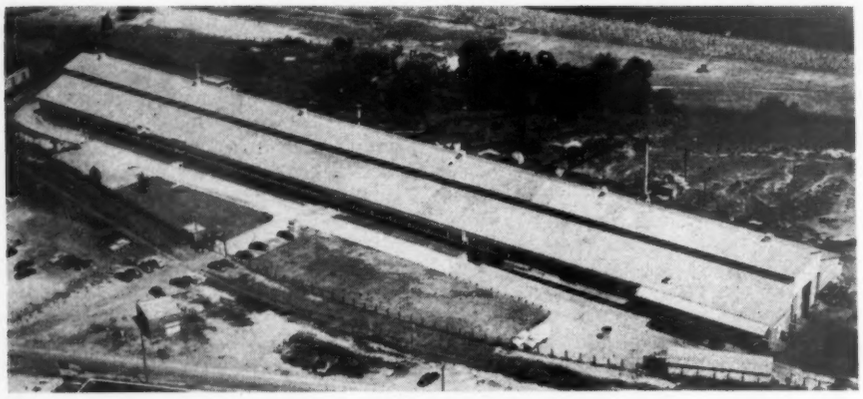
Trade News

Larger Offices Occupied

Goodall Rubber Company of Texas has moved into new and larger offices at 3550 West 12th Street, in Houston, Texas. The new building contains 8000 sq ft of space, cost approximately $80,000. The company moved from the old offices at 1606 Maury Street where it had been for 17 years. Larger warehouse space is included in the new

The new building includes the only rotary hose repair shop in the country, where damaged Goodall hose can be sent and the Barney coupling reset to prolong the life of the hose, the company reported. H. (Barney) Barnard is president of Goodall Rubber Company.

New Houston offices of Goodall Rubber Company.



Koehring Southern's plant in Chattanooga, Tennessee.

Koehring Sets Up Subsidiary

Koehring Company of Milwaukee announced the organization of another subsidiary company, known as Koehring Southern Company. This move has been made to provide increased facilities for the development and manufacture of new models of Koehring power shovels and cranes. It will not affect the present schedule of manufacture of Koehring construction equipment in the main Milwaukee plant. The Koehring Southern Company has purchased the Chattanooga, Tennessee, plant of the Norge division of Borg-Warner Corporation.

The new property consists of a modern factory 800 ft long and 120 ft wide, with total 100,000 sq ft of floor space.

Cenco Scholarships Out

Cenco scholarships offered annually for graduate study in the physical sciences by the Central Scientific Company, Chicago, have been awarded for the academic year 1952-53. The $1000 scholarship was won by Albert J. Rothman, who is studying for his Ph.D. degree at the University of California, Berkeley. The $1500 scholarship was awarded to William F. Miller studying for the Ph.D. degree at Purdue University.

U. S. Motors Expands

Stepping up its expansion in Los Angeles, California, to adequately provide facilities for an increasing backlog of orders, U. S. Electrical Motors, Inc., is now operating in five separate metropolitan points, all in close proximity. The actual increase in space recently acquired amounts to an additional 40 per cent of shop and office area of the Los Angeles facilities. While administration headquarters remain at the principal plant in the 200 block on East Slauson Avenue, other buildings have been leased within one mile to facilitate manufacturing and servicing.

New Agents Named

J. B. Smith, president, Pipe Line Development Company, announces an exclusive contract with the well-known exporting firm of R. S. Stokvis and Sons, Inc., New York 4, New York. M. F. Delano, vice president, R. S. Stokvis, will have charge of world-wide export distribution, except in Canada and Mexico, of Weld-Ends and all other products of Pipe Line Development Company.

Kewanee Boiler and Ross Form New Subsidiary

Kewanee Boiler Corporation and Ross Heater and Manufacturing Company, Inc., two divisions of American Radiator and Standard Sanitary Corporation, have combined to form a new company, Kewanee-Ross Corporation.

Both units of Kewanee-Ross will continue to operate as before, maintaining their respective plant locations, sales offices, and representatives. Unification of the management, personnel, and facilities of the two firms will provide a broader scope of operation.

Charles H. Currier, formerly president of Ross Heater has been named chairman of the board of Kewanee-Ross. W. Bradford Russell, formerly president of Kewanee Boiler, is president of the new firm.

Lane-Wells Company executives and general sales engineers met in Oklahoma City recently for the 1952 general sales conference. Plans for the coming year were presented by James D. Hughes, general sales manager, and review of the past year by Rodney S. Durkee, president.

Well Equipment Manufacturing Corporation held its annual sales meeting in Odessa, Texas, recently, more than 500 miles from the home office in Houston. Seen on its visit to a rig in West Texas is the entire group attending the meeting. They are: Sales managers John W. Gates, Weco, and G. R. Winder, Chicksan; A. H. Watts, representative, Weco; Frank Wiegand, field engineer, Walt Berntsen, sales representative, and Gus M. Bagnard, chief engineer, Chiksan; J. C. McCelvey, representative, Weco; Bev Ragsdale, representative, Chiksan; Bill Brien, Roy Shields, Eli Parker and Bill Hull, representatives, Weco; Jack Runnells, Canadian representative, Chiksan; Durk Durkin, representative, Weco; Pete Bily, product development engineer, Chiksan; J. H. Robinson, general manager, Weco; I. D. Abshire, Charley Gisler, Harry Rogers and Jimmy Llewellyn, representatives, Weco; Chuck Holcomb, special representative, Weco, and Foster Jordan, assistant sales manager, Weco, and company tool pusher.

Allis-Chalmers Set Up New Kansas City Branch

Contracts have been awarded by the tractor division of Allis-Chalmers Manufacturing Company for construction of a new, modern, one-story fireproof building to house its Kansas City, Kansas, branch now at 1224 West 12th Street. Knoop Construction Company, Kansas City, Missouri, has been named general contractor, and Sharp and Simon of Kansas City are the architects. The new branch will be situated on 12 acres of land two miles south of Independence, Missouri, a new industrial area.

Quaker Opens Dallas Branch

Quaker Rubber Corporation, division of H. K. Porter Company, Inc., has opened a new stock-carrying branch warehouse and sales office at 1327 Levee Street, Dallas, Texas. Establishment of this branch warehouse provides greater service opportunities and better deliveries to Quaker's customers in this area. D. C. Hahn has been named district manager and is in charge of the office. The branch will stock the complete line of Quaker's rubber conveyor and transmission belting, hose, packing, and moulded rubber products.

Cementing Story Depicted

A complete picture of what takes place under the ground during cementing procedures is available in a color film recently produced by Weatherford Oil Tool Company, Inc., of Weatherford and Houston, Texas. The length of the film is about 15 minutes. About one-half of the time is consumed with live action above the ground, while the remainder of the film presents an animated description of cementing the pipe in the hole. Installation of the cementing tools, scratchers, and centralizers, on the casing is shown in detail.

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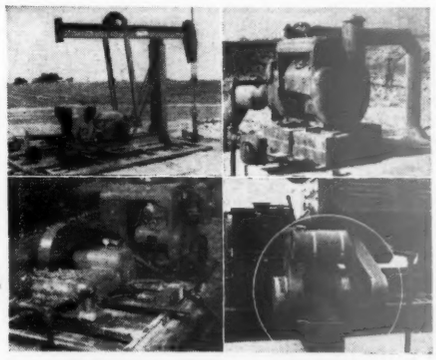

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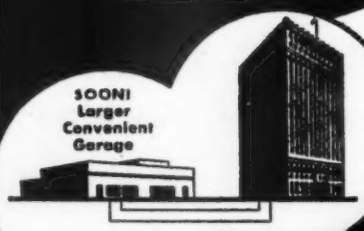

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Trade News

Continental Motors Builds Georgia Office, Warehouse

At East Point, Georgia, industrial suburb of Atlanta, Continental Motors Corporation is building an office and warehouse headquarters, which will provide the company, for the first time, with such a facility in the Southeast, C. J. Reese, president, announced.

L. J. Holland

The building, a single-story structure of brick, with limestone trim, covers some 20,000 sq ft. In charge of the Atlanta branch is L. J. Holland, who has been with Continental Motors since 1942. He is a graduate of the University of Illinois.

Johns-Manville Expands

A major expansion of the Johns-Manville plant at Watson, California, for the production of industrial insulations, was announced by A. R. Fisher, president. It is expected that construction of the building to house the new operations will be completed in the early Fall of 1953. The building will enclose about 100,000 sq ft of floor space.

Four Texas Offices Open

McCullough Tool Company has announced the opening of four new Texas service branches. The branches, situated at Sherman, Beaumont, Luling, and Hadacol Corner, will enable McCullough to give better service to the rapidly expanding Texas oil operations in their respective areas. This raises the total McCullough branches in the United States and Canada to 36, with 16 branches operating in major Texas oil fields. James E. Mitchell was appointed branch manager of the new Sherman sales and service center. The Beaumont branch is under the jurisdiction of V. M. Hocut, district manager, while D. M. Glass has been appointed branch manager at Luling and Sam Jones branch manager at Hadacol Corner.

Beckman Moves Offices Of Chicago Branch

To meet a growing need for additional space and to provide greater accessability to customers, the midwest offices of Beckman Instruments, Inc., have recently moved to a new location at 7145 West Belmont Avenue, Chicago, Illinois. The Beckman Chicago branch is under the direction of George Kincaid, a graduate of Northwestern University in Chicago.

Gates, Winder in Mexico

Following the close of an oil field sales meeting of Chiksan and WECO personnel in Odessa, Texas, G. R. Winder, vice president and general sales manager of Chiksan Company and Chiksan Export Company, and John Gates, sales manager of Well Equipment Manufacturing Corporation, a division of Chiksan, took an extended trip to Mexico, D. F. and the Mexican oil fields. The purpose of the trip was to gain first-hand information on the Mexican oil industry and to improve distribution in that country of Chiksan and WECO oil field equipment.

Turbine Pump Film

A new sound stripfilm (slides on continuous 35 mm strip), entitled "The Vertical Turbine Pump Story" has just been released by Worthington Corporation. The film containing 165 frames, in color, is sychronized to a 20-min narration. It points out the four inherent characteristics of vertical turbine pumps which make them particularly suitable to applications other than use in deep wells.

Hammond Licenses Vulcan

Negotiations recently completed between Hammond Iron Works of Warren and Bristol, Pennsylvania, and the Vulcan Iron and Engineering Company of Winnipeg, Manitoba, make available in Canada all Hammond designs of conservation storage tanks as well as standard API oil storage tanks. With plant and head offices at Winnipeg, Vulcan will fabricate and erect tanks of Hammond design throughout Canada.

Melvin Sisk (second from left), manager of the Sherman, Texas, Chamber of Commerce, welcomes McCullough Tool Company to Sherman at recent open house at the new McCullough branch. Pictured below are: Clarence Robertson, district manager; Sisk; Bob Smith, eastern division public relations director, and James Mitchell, branch manager of the new sales and service center. This made a total of 16 Texas branches.

Du Pont Company Observes 150th Anniversary in 1952

The du Pont Company is celebrating its 150th anniversary this year. The occasion was observed by employees and members of the du Pont family in ceremonies at the site of the company's first mills in Wilmington, Delaware, recently. An anniversary book has been published entitled "Du Pont—The Autobiography of an American Enterprise," which traces the company's role in the growth and development of the nation. Pictures and text sketch the broad social and economic patterns of America during the last century and a half, underscoring the company's growth as it paralleled the nation's expanding needs. The company was founded in 1802 by E. Irenee du Pont de Nemours for production of black powder. In 1832 the company added to its line refined saltpeter, refined charcoal and other products. In 1880 production of nitroglycerin and dynamite began.

Present president of the company is Crawford H. Greenewalt. Lammot du Pont, grandson of the founder served as president of the company, as did three of his sons.

Lunkenheimer Gets Award

The Lunkenheimer Company was one of two exhibitors receiving awards for the most informative displays at the 37th annual convention and Inform-A-Show of the National Association of Purchasing Agents, held recently in Atlantic City, New Jersey. Exhibits sponsored by manufacturers from coast-to-coast were entered in the competition and judging was solely on the basis of the displays presenting the best, most helpful information to the 3100 purchasing agents who attended the convention.

Marmon-Herrington Marks 21st Birthday

Marmon-Herrington Company, Inc., Indianapolis, Indiana, is celebrating its 21st anniversary this year. Founded in 1931 by the late Walter C. Marmon and Arthur W. Herrington, the company has grown from a small custom builder of large multiple-drive vehicles to become a large producer of all-wheel-drive trucks, and transit vehicles.

In celebration of its 21st anniversary, Marmon-Herrington has announced a new line of heavy-duty all-wheel-drive trucks, known as the "600" Series.

Koppers New Plant Producing

First production of tar-base enamel pipe line coatings and roofing pitches in a plant built west of the Rocky Mountains began in Fontana, California, recently. This was announced by Koppers Company, Inc., which is constructing a tar products plant adjacent to Kaiser Steel Company property. The plant will process tar received under contract from Kaiser's coke ovens. Additional production at the plant will come after a large tar processing still, now under construction, is put into operation.

Metering Company Formed

The Oil Metering and Processing Equipment Corporation, offering a complete line of wellcheckers and metering units for oil producing companies, has

G. A. Repal

H. V. Smith

been formed in Houston, Texas. Founders of the new firm are H. Vernon Smith, president and general manager, and George A. Repal, vice president and secretary.

The new corporation, with headquarters in Houston, will operate under the trademark, OMECO. Their line of metering equipment will include wellcheckers, metering separators, and oil, gas, and water meters. Processing equipment will include emulsion treaters, water knockouts, water filters (sand and gravel packed), and oil and gas separators.

Olson Nordberg Agent

Appointment of Olson Equipment Company, 2930 Blaisdell Avenue, Minneapolis, as distributor for Nordberg 4FS diesel engines in Minnesota and northwestern Wisconsin is announced by Nordberg Manufacturing Company. Manufacturers and distributors of construction equipment and supplies, the Olson firm began operation in 1945. R. E. Olson is president of the organization; F. L. Gruber, vice president; S. C. Olson, treasurer; B. W. Olson, secretary; J. Novotney, office manager, and O. Kirsch, service manager.

Filtrol Holds Annual Foreign Agents Meeting

Filtrol Corporation, through its export manager, Troy Monk, and other members of the organization, welcomed representatives from more than 20 countries at the second International Foreign Agents' meeting of Filtrol Corporation in Los Angeles, California, recently.

Albert C. Dankelman, Socotecnic, Belgium; Carl G. Hunt, Otis, McAllister, Colombia, Venezuela; Central America; Robert G. Burke, Atkins, Kroll, Philippine Islands; Fred S. Stevens, Dominion Oil, New Zealand, and Renato Ibarra, Ernesto Ibarra y Cia., Mexico, attended the meeting. Others were: Nicolas Bensmann, Dr. Herman Bensmann, Germany; Rolando J. Longoni, Argentina; W. N. D. Stevens, Stemco, Ltd., Great Britain; Abel Lopes Martins, Abel Lopes Martins, Ltd., Portugal; F. Yamaguchi, Tokyo Boeki Kaisha, Ltd., Japan; C. G. Gips, W. R. Grace, Chile and Peru; Axel Axelsen, Alf Axelsen, Norway, and Bondi M. Saporta, Egypt.

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Trade News

American Cyanamid Forms Sales Service Department

American Cyanamid Company has announced the formation of a sales service department for its industrial chemicals division. A. J. Campbell, general manager of the division, explained that the move is in conjunction with a reorganization program. Appointed manager of the new sales service department was R. C. Sarfaty, who formerly served as a product supervisor for Industrial's heavy chemicals department. A graduate of Princeton University in 1943, he joined Cyanamid in 1945.

Cleco Appoints Agents

The Cleco division of the Reed Roller Bit Company, has announced the appointment of Oliver H. Van Horn Company, 1742 St. Charles Avenue, New Orleans, Louisiana; Bethlehem Supply Company, Inc., Bethlehem, Pennsylvania, and Peerless Supply Company, Inc., Shreveport, Louisiana, as distributors for Cleco products in their areas.

OCT's 25th Year Celebrated

Twenty-five years ago, Oil Center Tool began business in Houston in a small machine shop measuring 18 by 20 ft. Original equipment in the O-C-T shop consisted of a milling machine, drill press, shaper, and two engine lathes. Today, the company's plant occupies more than 50,000 sq ft of floor space, with further expansion underway.

In the quarter of a century since the company opened its doors on August 28, 1927, the oil industry has made great advances. Arthur J. and Kirby T. Penick saw the need back in 1927 for a small machine shop intended primarily for doing special work for Houston firms with heavy industrial equipment. Another Penick brother — Edward — who worked at a Houston bank, set up the bookkeeping system for the company.

Two years later—in 1930—the great East Texas oil field came taxing the ingenuity and facilities of the young oil tool manufacturing industry. The company made two notable contributions the first year East Texas wells flowed: Oil Center tubing and casing heads.

In the early years of the boom, O-C-T engineers decided that it would be feasible to assemble Christmas trees in the Houston plant and ship them to East Texas ready for installation. Their plan worked. In addition to saving valuable time and strengthening safety precautions at the well, the engineers found another strong advantage: The Christmas trees could be pre-tested at the factory.

Precipitators Planned

Research Corporation has been awarded two contracts covering installation of the new wet-bottom type Cottrell electrostatic precipitators for recovery of salt cake and sodium salts in pulp and paper mill applications. Maxon Construction will handle Research Corporation precipitator installation for the Rome Kraft Company sulfate mill in Rome, Georgia. Ebasco Services will install two precipitators for Rayonier, Inc., Doctortown, Georgia. Each precipitator will recover sodium sulfate from 100,000 cu ft per minute of gases at 300 F at 90.5 per cent.

Chicago Pneumatic Begins Fort Worth Plant

Ground breaking ceremonies for a new plant that will manufacture oil well drilling equipment for the petroleum industry were held recently by the Chicago Pneumatic Tool Company at Fort Worth, Texas. The ground breaking signalled the start of construction of a plant that will contain approximately 130,000 sq ft of floor space, according to the company and Walter Kidde Constructors, engineers, and builders of New York and Houston, in charge of the design and construction program. The plant will provide facilities for machining, grinding, heat treating, and hard facing oil well drilling bits.

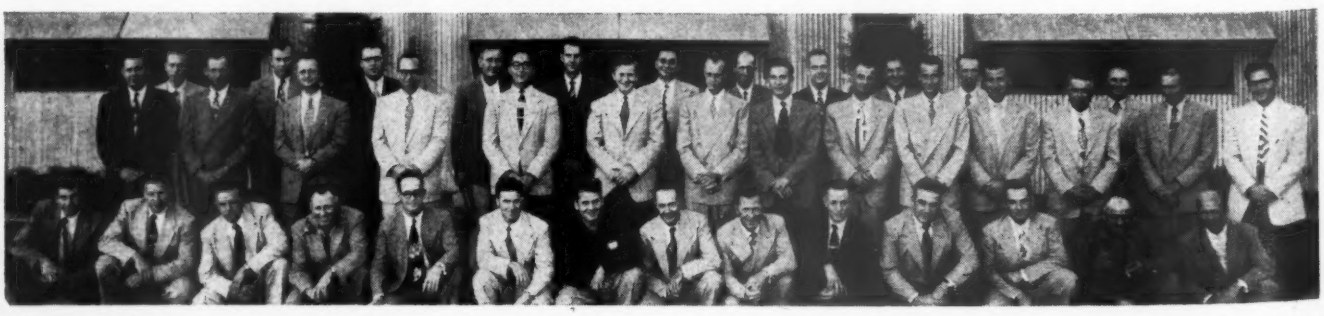
Graver Expands Facilities

Because of steadily increasing business, the main office of Graver Water Conditioning Company, which was removed from Chicago to New York three years ago, has doubled its space at 216 West 14th Street. All departments have been enlarged, and additional departments, including research and product development, field service, and subdivisions of the engineering department, have been created.

Blaw-Knox Signs Contract

Blaw-Knox Company has reported that all plants of the company are in full operation following the signing last week of an interim agreement with the CIO United Steel Workers. W. C. Snyder, Jr., president of Blaw-Knox, said that shipments are being resumed on all company products.

National Tank Holds Annual Sales Meeting. Attending the meeting, which was held on June 6 and 7, were: Back row, Earl Keck, Marvin Willis, H. D. Jones, Joe Wells, Tracy Smith, Bill Wallace, Ed Fontaine, Floyd Senter, Chester Immel, Les Lamb, Ed de Young, Lynn Burrus, Don Boling, Rex Williams, Bill Dunn. Middle row: Sam Mays, Herb Walker, Bill Willis, Charles Purser, Bill Little, George Steinhaus, Joe Marshall, Reed Speir, L. M. Jewett, Red Brinkley, Bill Bechtold, Bill Becker, Ward Guin, Sherman Barclay. Front row: Merle Bryan, A. H. Vanderlee, Jim Brown, Neely Lowrie, Clem Kier, Lloyd Conley, George Powers, Dud Lowrie, Jack Williams, and Johnny Shelton.



The second National Tank meeting was held on May 23 and 24. Those attending, were: Standing, Jim Tallant, Paul Meyers, T. R. Hoffman, T. R. Graham, Jay Stafford, Dick Brooks, Bill Addison, Paul Hughes, Louie Edmonson, Cliff Hill, J. D. Thomas, Warren Gray, C. W. Gilbert, M. T. Harrison, Rex Meyers, Bill Wilson, Herb Hudson, E. J. Perero, J. S. Chism, Harry Mitchell, Joe Notley, Bill Kidder, H. C. Butler, Rex Ricketts, Marvin Whited. Kneeling, Leo Barbee, Joe Green, Bill Akin, Ralph Delashaw, Don Standley, Russel Morris, B. L. Nugent, R. J. Bourgeois, O. A. Claunch, Elvis Guin, Paul Jake Myers, John Swiney, Johnny Powers, and Everett Miller. Representatives from the 41 branches participated in the meeting.

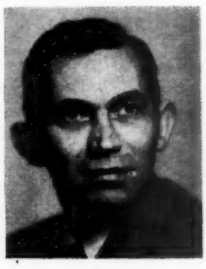
TRADE PERSONALS

Ralph E. Hope has been appointed manager of research engineering of The Davison Chemical Corporation, Baltimore. Hope has for the last two years been Davison's representative at Warrington, England, on the design and operation of a plant built by an affiliate of Lever Brothers and Unilever Ltd., for the production of petroleum cracking catalyst by the Davison microspheroidal process.

R. E. Hope

H. C. Brand has moved from his post as assistant area manager at Tulsa to North Central Texas division manager at Dallas, Texas, for Schlumberger Well Surveying Corporation. **M. L. Millican** has been transferred from Kermit, Texas, to Midland, where he is district manager. Replacing Millican at Kermit is **J. W. Little.** Little attended Tulane University and joined Schlumberger in 1948. **J. L. Heath** leaves his position as district manager at Kenedy, Texas, to take the same position at Wichita Falls.

H. C. Brand



L. A. Allaud

Replacing Heath at Kenedy is **J. B. Markolf** who moves from Columbus, Texas, where he opened the new Columbus district office last November. Markolf attended the University of Nancy in France and joined Schlumberger in 1947. **Lee Petty** has been made district manager at Columbus replacing Markolf. Petty is a graduate of Texas A. & M. College.

J. C. West has been transferred from Tyler, Texas, where he has been field engineer, to the management of the district office at Magnolia, Arkansas. **C. F. Schwab** takes over the duties of resident engineer at the Mt. Pleasant, Michigan, station. Moving to the headquarters staff at Houston are **R. P. Alger** and **J. S. Kellough.** Alger comes from Magnolia, Arkansas, where he has been district manager since 1942, to join the operations department in Houston. He is a graduate of the Missouri School of Mines and Metallurgy.

L. A. Allaud, recently returned from a 4-year period of service with Schlumberger Surenco, S. A., in Venezuela, has been made assistant area manager of the newly created Northwest Texas area under the direction of **J. A. Bodin.**

Russell P. Northup, Crouse-Hinds Company commercial vice president, assistant sales manager, has been assigned full responsibility for condulet sales. Northup has been with Crouse-Hinds as field representative and assistant sales manager for 17 years.

William A. McAuley has been appointed manager of the condulet department of Crouse-Hinds Company, Syracuse, New York, in which capacity he will assist Northup.

Charles C. Reiff has been named as chief engineer of Rockwell Manufacturing Company's Barberton division, Barberton, Ohio, and **Bernard Last** to succeed him as project engineer of the lubrication department at Rockwell's home office in Pittsburgh, Pennsylvania. Reiff received his degree in mechanical engineering from the Drexel Institute of Technology. He joined Rockwell in 1950. Last is a graduate of the Cooper Union Institute of Technology and also attended graduate courses at the Brooklyn Polytechnical Institute.

C. C. Reiff

Bernard Last

E. G. Bailey, founder and president of the Bailey Meter Company and director and consultant of Babcock and Wilcox Company was presented with the Distinguished Service Award of Ohio State University during commencement exercises, recently. Bailey was cited by the university president for his contributions to the engineering profession and for his work in the engineering manpower field.

Travis A. Brown has been appointed by the Hunt Export Company as their representative in Venezuela. Brown was previously associated with a major oil company in this South American country. His office is in the Avila Hotel, Caracas, Venezuela. Brown will handle all tools and equipment distributed by the Hunt Export Company.

James R. Rapier has joined Bethlehem Supply Company as engineering representative with headquarters in Tulsa, Oklahoma. He has had 16 years experience in the compressor and pipe line pump field, and will continue his endeavors along similar lines throughout the Mid-Continent area.

T. J. Walne

A. R. Meyer

Thomas J. Walne, formerly head of the export division, National Supply Company, has been appointed general manager of oil field sales. His staff will consist of R. W. Gordon, sales manager, merchandising products; M. E. Swaim, sales manager, production equipment; W. T. Cushing, sales manager, drilling equipment; and H. E. Heywood, manager, general sales office. Gordon, Swaim, Cushing, and Heywood were among personnel transferred from Toledo.

A. R. Meyer has been appointed manager of the company's export division in New York City. Sales activities will be handled by **E. M. Gretzler,** sales manager. **Calvin B. Carter** has been promoted to assistant sales manager and **R. Carson Allan** has been promoted to division engineer.

David W. Martin of Signal Mountain, Tennessee, has been appointed district sales manager in charge of the Atlanta, Georgia, office of The Youngstown Sheet and Tube Company. Martin, a member of the Atlanta sales staff for 23 years, succeeds William Walton Ford, who died June 11. Martin began working at the age of 16 as a rodman for DuPont Engineering Company. On April 1, 1929, he joined The Youngstown Sheet and Tube Company as a salesman in the Atlanta district.

Myran J. Livingston has been named assistant to the president of Arthur G. McKee and Company. In his new position Livingston is to assist in directing the activities of the company's petroleum refining division. For the past several years he has been sales manager of the company's petroleum refining division, and prior to that he had been in charge of the company's sales office in New York.

John Herold, vice president and sales director of Camco, Inc., of Houston, Texas, left recently on a tour of the Williston Basin and Canadian oil fields. Before returning to Houston Herold will attend the Devon Oil Show in Canada.

John V. Herasimchuk, general manager of International Gas Lift, S. A. of Caracas, Venezuela, has been in the United States on a six weeks visit. His company represents Camco Gas Lift equipment in South America.

J. V. Herasimchuk

Trade Personals

E. J. Lickwar has been named sales representative in the Pittsburgh, Pennsylvania area by the Alloy Steel Products Company, Inc. Lickwar replaces **Herbert V. Evans, Jr.**, who was recently made district manager for Alloy Steel Products Company at Wilmington, Delaware.

W. H. T. Furry has been named associate director of The Foxboro Company's training school staff. Well known in the instrument industry as training co-ordinator at the Atlantic Refining Company in Philadelphia, Furry has also taught courses in instrumentation for Pennsylvania State College and the Philadelphia section of the Instrument Society of America.

Fred Tod, Jr., has been named a director of the Youngstown Sheet and Tube Company and **J. L. Mauthe**, president of the company, to fill the vacancies created by the resignation of John Tod, who has resigned after 29 years with the company.

John Tod was vice president of Brier Hill Steel Company when it was purchased by Youngstown Sheet and Tube in 1923. He became a director of Sheet and Tube, and in 1932 was elected to the company's executive committee. Fred Tod, Jr., a graduate of Babson Institute in Boston, is a partner with Walter Meub, Jr., in Bruce and Company, insurance.

Mauthe joined the company in 1935 as assistant superintendent of the Campbell plant. He became a company director in 1946 and president in 1950.

Directors elected three other persons to positions with the company. They are: **Robert F. Doolittle**, vice president, legal, of Baldwin-Lima-Hamilton Company, as assistant general counsel and assistant secretary of the company; **Floyd D. Hunter**, assistant secretary for several years, to assistant general counsel, and **K. Calvin Sommer**, assistant treasurer to succeed Joseph B. Sugden who retired last month. Sommer will continue as credit manager, a post he has held since 1940.

John H. Burns, office manager for Alcoa Mining Company, petroleum division, Houston, was elected a national director of the National Association of Cost Accountants at the annual meeting of the association in New York. Burns was president of the local chapter of NACA in 1950-51.

John H. Burns

M. F. Ohman has been appointed assistant general manager of the western division of The Dow Chemical Company. Ohman, who has been the division's production manager for the past 9 years, has been associated with Dow since 1930 when he began as a chemical engineer in the company's Midland, Michigan, headquarters. **H. H. Smith** has been promoted from assistant production manager to production manager of the division. Smith also began his Dow career in the company's Midland laboratories.

R. Austin

W. Ward

Dr. Robert Austin, formerly with Consolidated Engineering Corporation, Pasadena, California, for four years, has joined Beckman Instruments, as specialist in the development of titration instruments. Dr. Austin received his BA and MA degrees in chemistry at the University of Utah and his Ph.D. in inorganic chemistry at the University of Wisconsin. **Dr. William Ward**, a native Chicagoan, has joined Beckman, South Pasadena, California, as research-staff specialist in infrared instrument design.

Dr. Ward's extensive experience in infrared spectroscopy will be devoted to furthering Beckman advancements in this field of instrumentation. He was formerly a spectroscopist with The Texas Company in its research laboratory in Beacon, New York.

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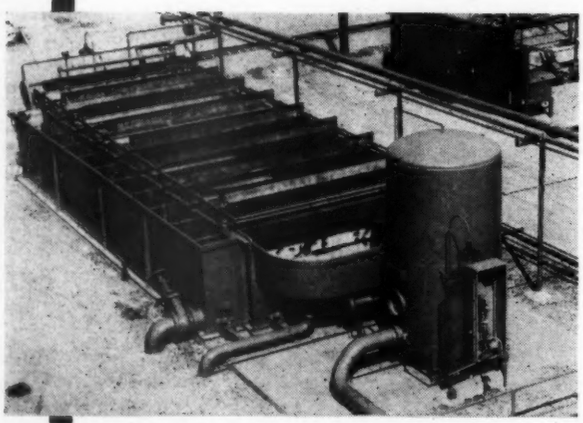
OIL PRODUCTION & OIL REFINING WASTE WATER

BULKLEY-DUNTON colloidair

DISSOLVED AIR FLOTATION UNITS

augment or replace gravity separators with these efficiencies:

Operation	Gravity Separation Parts Per Million	Colloidair
Drum wash	129	3.4
Tank-car wash	5,180	4.7
Refinery "A"	82	5.0 to 7.0
Refinery "B"	142.5	58.0
Refinery "C"	232.0	2.0
Oil-field brine "A"	40.0	5.0
Oil-field brine "B"	300 to 500	1.0 to 6.0



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- meeting pollution requirements
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R. M. Bode

Richard M. Bode has been named to an executive sales position in Ladish Company's valve and fittings division. Formerly with Tri-Clover Machine Company as vice president and sales manager, Bode will be responsible for the marketing of a newly introduced line of forged steel valves.

Ralph M. Watson has been named director of research for Worthington Corporation, upon retirement of Paul Diserens, after 43 years service. Watson was graduated from the California Institute of Technology with a BSME degree in 1927. He joined Worthington in 1936.

Diserens will continue with the corporation in a technical consulting capacity in engineering and research. He joined Worthington (then known as the International Steam Pump Company) in 1909, where he was placed in charge of research testing at the Laidlaw Dunn Gordon plant in Cincinnati.

Thomas C. Madden has been appointed sales engineer in the packaged compressor division of the J. B. Beaird Company. He graduated in May from Southern Methodist University where he received a BS degree in mechanical engineering. Madden served in the Navy during World War II in the repair and manufacturing of aircraft structural parts.

David W. Jones, Jr., sales representative for the tubular products division of The Babcock and Wilcox Company, Beaver Falls, Pennsylvania, has opened new offices in the Goby Building, Denver, Colorado. Jones handles the division's complete line of seamless and welded, carbon, alloy, and stainless steel tubing in the Rocky Mountain area.

L. G. "Jerry" Johnson has been added to the sales staff of Lone Star Steel Company. He will be in charge of sales of steel tubular goods. Company officials have indicated that the new mill will begin producing pipe by January 1, 1953, provided no unforeseen delays in delivery of materials and equipment occur.

M. E. Ziegenhagen has been named advertising and sales promotion manager of Worthington Corporation. Ziegenhagen has been associated with General Electric Corporation since his graduation from the University of North Dakota in 1937 where he was awarded a BS degree in mechanical engineering. In 1941 he became acocunt supervisor in General Electric's Shenectady plant.

M. E. Ziegenhagen

Raymond A. Rich has been appointed vice president of the refrigeration division of Philco Corporation. Rich will be responsible for the development and pricing of refrigerators, freezers, electric ranges, and room air conditioners.

Harold W. Schaefer was appointed as vice president—engineering of the refrigeration division. For the last 15 months Schaefer has acted as special assistant to Leslie J. Woods, vice president and director of research and engineering of Philco Corporation.

Gerard E. Nistal has been appointed advertising and sales promotion manager for the government and industrial division of Philco. A wartime Air Force and Navy veteran, Nistal was previously affiliated with the Radiomarine Corporation of America, and Lear, Inc.

Louis J. Prior, traffic manager of The National Supply Company at its Toledo, Ohio, plant, has been appointed assistant general traffic manager for the company. He will make his headquarters at the company's executive offices in Pittsburgh. Prior worked for the New York Central Railroad before joining National Supply in 1921.

L. J. Prior

Roy Crawshaw, an executive of Western Gear Works, was elected president of the American Gear Manufacturers Association at its recently concluded sessions in Hot Springs, Virginia. Crawshaw has been with the company for 10 years. Crawshaw makes his headquarters at the executive offices of the company, located in Lynwood, California.

H. D. Leisenring has been named as sales manager, eastern area, of A. O. Smith Corporation. He will make his headquarters at the Eastern factory at Succasunna, New Jersey. Formerly sales manager, Pacific Coast area for the meter division, Leisenring has over 20 years experience in engineering and sales of service station pumps and petroleum meters.

H. D. Leisenring

Colonel W. F. Rockwell, chairman of the board, Rockwell Manufacturing Company, left New York recently by plane for Europe where he expects to visit at least five plants in England, France, Italy, and Germany, which are now manufacturing Rockwell products. These British and European plants manufacture Rockwell designed products under an engineering agreement which compensates Rockwell for royalties and also for engineering and sales consulting services. Rockwell revealed that two new agreements are being negotiated which call for the products to be manufactured under its trade name.

P. M. Buhrer

C. O. Kleinsmith

P. M. Buhrer and **C. O. Kleinsmith** have been appointed executive vice presidents of National Carbon Company, a division of Union Carbide and Carbon Corporation. Both Buhrer and Kleinsmith have been with National Carbon Company for many years, Buhrer having been associated with research and development activities and Kleinsmith with sales. Buhrer was graduated from Johns Hopkins University in 1923 and joined National Carbon the same year. Kleinsmith joined National Carbon in 1914.

Dr. Eugene T. Miller, a graduate of State Real Gymnasium, Real, Germany, has been named to the engineering department of Hooker Electrochemical Company. He was a supervisor of research at the Hungarian American Oil Company, leaving in 1944 on the arrival of the Russian force. **Alfred W. Toon** has been hired as a designing engineer. His experience covers a number of years as draftsman, maintenance engineer, structural engineer, etc.

Herbert K. Holden is new salesman in the Niagara sales territory, which comprises western Pennsylvania and New York state exclusive of the metropolitan area.

George C. Wilder has been appointed a director to fill the unexpired term of the late Jessel S. Whyte, and elected president of Macwhyte Company. Wilder was vice president and assistant general manager and has served in various capacities since joining the company in 1938 after receiving a B.A. degree from Cornell University.

Otto G. Wenzel has been appointed sales engineer in the New York office of the heavy machinery division, Nordberg Manufacturing Company. Wenzel was formerly eastern sales manager of the diesel engine division of Baldwin-Lima-Hamilton Corporation. Wenzel was graduated from Xavier University in Cincinnati.

John H. Conroy was appointed sales manager for the Rosson-Richards Companies. He will be in charge of both the coating and wrapping and the Wate-Kote divisions of Rosson-Richards. Conroy was southern district sales representative of the Barret division of the Allied Chemical and Dye Corporation.

J. H. Conroy

REPUBLIC NATIONAL BANK
OF DALLAS, TEXAS

Statement of Condition, June 30, 1952

RESOURCES

Cash and Due from Banks	$168,810,426.66
U. S. Government Securities	74,159,790.84
State, Municipal and Other Securities	6,608,608.26
Stock in Federal Reserve Bank	1,275,000.00
Loans and Discounts	229,687,507.77
Real Estate — New Building and Equipment	5,972,636.68
Acceptances — Customers Account	4,497,701.79
Total	$491,011,672.00

LIABILITIES

Capital	$ 21,000,000.00	
Surplus	21,500,000.00	
Undivided Profits	5,311,944.10	47,811,944.10
Reserve for Monthly Dividend, Payable July 1, 1951		199,500.00
Reserve for Contingencies		3,387,746.63
Reserve for Taxes, Etc.		3,236,478.01
Acceptances — Customers Account		4,497,701.79
Deposits:		
Individual	288,082,599.76	
Banks	128,048,067.12	
U. S. Government	15,747,634.59	431,878,301.47
Total		$491,011,672.00

★ ★ ★

Assets of the Republic National Company, with capital stock of $3,000,000, are not included in above statement. The Company owns majority stock in the following banks located in Greater Dallas:

FAIR PARK NATIONAL BANK
GREENVILLE AVENUE STATE BANK
HIGHLAND PARK STATE BANK
LAKEWOOD STATE BANK
NATIONAL CITY BANK
OAK CLIFF BANK & TRUST CO.
OAK LAWN NATIONAL BANK

Resources of the Republic National Bank and the above Banks aggregate $601,120,718.46

"Well Bank" . . . the strong, friendly bank

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Trade Personals

L. E. Ferguson

A. L. Wallace

Laurence E. Ferguson has been named to the field sales staff, Iverson Supply Company of Tulsa, with headquarters in Tulsa. Ferguson is a graduate of the University of Oklahoma, and began working in the industry in 1926 during the Seminole boom in Oklahoma. For the last 15 years he has been actively identified with the sales of machinery, tubular goods, and supplies.

Arthur L. Wallace was named as assistant treasurer and general credit manager of the company. Wallace attended Tulsa University, Texas Christian University, and the Graduate School of Credit and Financial Management at Dartmouth. He was division credit manager of the Gulf Coast division for National Supply and was with First National Bank, Tulsa, before joining Iverson.

R. W. Malcolmson has been named technical representative for the Southwest, by the rubber chemicals division of E. I. du Pont de Nemours and Company. Malcolmson has had 10 years experience in the rubber industry. The last five have been with du Pont.

C. J. Berini has been appointed division manager, Wayne, Michigan, division, Gar Wood Industries, Inc. **H. D. Chicoine** has been named to the position of assistant division manager. Formerly Wayne division works manager, Berini has served more than 20 years in the manufacturing industry. Chicoine has served as factory manager since 1945. Previously, he was with General Motors Corporation as an engineer in the Fisher body and Ternstedt divisions. Berini joined Gar Wood in 1951.

Edward R. Hayes, formerly with the research department of Standard Oil Company (Indiana), has recently joined the sales staff of the catalyst division, National Aluminate Corporation. Prior to joining Standard Oil, Hayes attended the University of Maine and Cornell University.

Paul J. Foley has been named manager of Worthington Corporation's Kansas City office and **William M. Fine** manager of its Milwaukee branch office. Foley joined Worthington in 1937 after completing the Worthington Student Training Course. He is a graduate of Northeastern University. Foley succeeds **W. R. Kennedy,** who has been named a consultant to his successor. Fine was graduated from Lehigh University. He took the Worthington Student Training Course in 1933 and in 1943 joined the sales force in the Chicago office.

Harry F. Vickers, founder and president of Vickers, Inc., was elected president of The Sperry Corporation to succeed **Thomas A. Morgan,** retired. Vickers' association with The Sperry Corporation began in 1937 when Vickers, Inc., became a Sperry subsidiary. **Kenneth R. Herman,** vice president and general manager and a director of Vickers, Inc., was elected vice president of Sperry Corporation. **E. A. Pierce,** president of the Sperry Corporation, was elected chairman of the board and **John Sanderson,** formerly vice president for finance and treasurer, was elected senior vice president and treasurer.

Lloyd A. Blankenship has been appointed to Oakite Products' petroleum service division in line with the company's continuing expansion program in the petroleum field. Operating from the company's Los Angeles offices, he will assist its Pacific Coast field representatives in providing additional technical advisory service on petroleum-industry cleaning and related problems. Blankenship was formerly manager and consulting engineer of the Olathe Machine Company.

L. A. Blankenship

Harold R. Fosnot has been named assistant general sales manager, and **Leonard Limon** manager, sales engineering department, for Graver Water Conditioning Company.

Fosnot is a graduate of Purdue University and the University of Chicago. He came to Graver in 1935. Limon was graduated from City College of New York and New York University. He joined Graver in 1949.

Robert W. White has been elected a director of the American Locomotive Company. Formerly a vice president and treasurer of Union Carbide and Carbon Corporation, White now is a member of Robert White Associates, business consultants, of New York City. After graduation from Cornell University in 1915, White joined the Linde Air Products Company, which later became part of Union Carbide and Carbon. In 1949, White resigned his position with Union Carbide and Carbon to form Robert White Associates.

Vincent E. McMullen, vice president, Cummins Engine Company, Inc., Columbus, Indiana, is celebrating his 50th year of working in the internal combustion engine industry. He graduated as an electrical engineer from the University of Wisconsin in 1905. In 1935, McMullen accepted a position with Cummins as works manager then as vice president.

V. E. McMullen

Curtis R. Cross has been appointed development engineer for BJ Service, Inc., Long Beach, it was announced recently by John B. Merritt, vice president and general manager of BJ Service, Inc. Cross was formerly superintendent of tools for the Spartan Tool and Service Company of Houston, and has been associated with Baker Oil Tools, Inc., of Los Angeles and the Halliburton Oilwell Cementing Company.

C. R. Cross

O. E. Tony Bright, Leonard F. Chilton, and **John S. Hatcher** have been named sales engineers for Lane-Wells Company in the Mid-Continent division. **Tom Caton** and **Charles Viverette** are sales engineers in the Gulf Coast division. Expanding operations in these two divisions resulted in the new assignments. Bright, who began his Lane-Wells career in 1948 is a district sales engineer in the Mt. Carmel, Illinois, area. Chilton has spent 4 of his 5 years with Lane-Wells as a combination operator in Cody, Wyoming. He will remain in the same office as district sales engineer.

Hatcher joined the company in 1946, and will now serve as district sales engineer with headquarters in Guymon, Oklahoma. Caton joined Lane-Wells in 1946; his headquarters will be in Beaumont, Texas. Viverette worked as a rigman on a Lane-Wells gun perforator following his graduation from Mississippi State University. In his new assignment, he will be sales engineer at Odessa, Texas.

E. A. (Ed) Denning has been appointed to the Technical Oil Tool Corporation staff at Snyder, Texas. Denning replaces **A. D. Tucker,** who was transferred to Williston, North Dakota. Denning, working under the direction of F. E. Siever, West Texas division manager, will be stationed in Snyder, and service the Continental stores area at Snyder and San Angelo.

E. A. Denning

William Balderston, president of Philco Corporation, has been elected to the board of trustees of the committee for economic development. Others whose election as CED trustees was announced are: **James L. Allen** of Chicago, senior partner and chairman of the executive committee of Booz, Allen and Hamilton; **Charles R. Cox** of New York, president, Kennecott Copper Corporation; **Gordon Gray,** president, University of North Carolina; **George H. Love,** president, Pittsburgh Consolidated Coal Company, and **Stanley Marcus** of Dallas, president, Neiman-Marcus Company.

Ledeen
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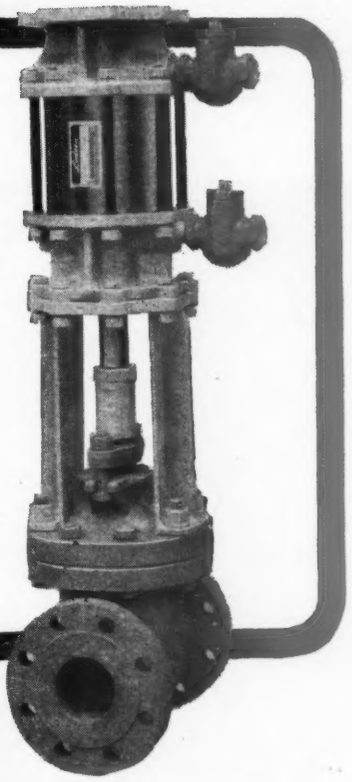

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Trade Personals

George Gilliam and **C. J. Smolinske** have been named to industry sales managers' posts for the industrial division of the Minneapolis-Honeywell Regulator Company. Gilliam will be in charge of sales of the company's products for all types of engines and test facilities. Smolinske has been named industry sales manager for pyrometer supplies, a post formerly held by Gilliam. Both will have their office in Philadelphia.

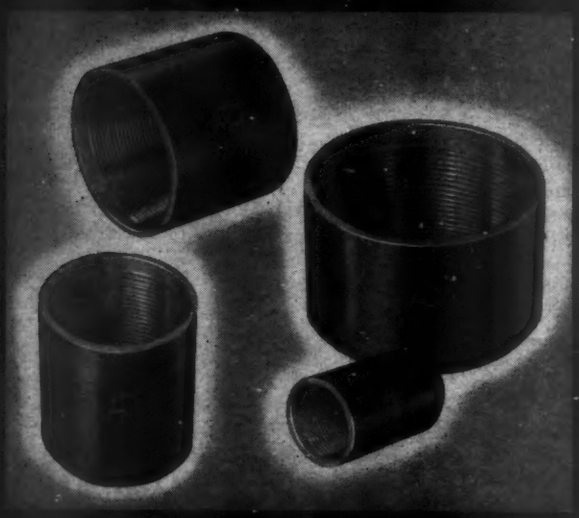
John F. Powers, Jr., has joined the Newark sales office of Chiksan Company. He has previously been associated with Manne-Knowlton Insulation Company as sales engineer and H. O. Canfield Company as sales representative.

Thomas R. Simkins has been named branch manager at Detroit, Michigan, and will direct transportation sales for Glass Fibers, Inc., Toledo, Ohio. Simkins was formerly vice president and a director of the Glasfloss Corporation.

Edward Stanko, veteran RCA engineer and pioneer in radio and television in the 1920's, has been appointed to the newly created post of manager of engineering, technical products division, RCA Service Company, Inc. In his new position, Stanko will direct specialized training of field personnel, preparation of technical information, and development of new methods for installation and servicing of RCA products.

The character of the manufacturer

shows in the product



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Harrisburg Steel CORPORATION

HARRISBURG 7, PENNSYLVANIA

Frank E. Prosser, formerly field salesman at Liberal, Kansas, for Continental Supply Company, has been named manager of the company's Cody, Wyoming, store. **Hollis C. Beeson** has been named manager of the Shreveport, Louisiana, store, having served as field salesman at the same location. Formerly floorman at Russell, Kansas, **Floyd R. Johnson** has been made manager at that point. New store manager of the Farmington, New Mexico, store is **Bill Evans,** who has been serving as field salesman at the same location.

Also announced by Continental is appointment of **J. R. Osteen** to district refinery salesman at Shreveport. He has been manager of the store at that location.

Sid Shuman, general sales manager, Fluid Packed Pump Company, recently returned from a three months' trip throughout South America where he visited Argentina, Chile, Peru, and Venezuela. He spent considerable time in Eastern and Western Venezuela where National Supply Company of Venezuela maintains extensive shops for servicing Oilmaster down-well pumps.

Sid Shuman

Mary Hensarling, librarian of Baroid Sales division, National Lead Company, Houston, has been elected vice president and president elect of the Texas chapter of the Special Libraries Association for 1952-54. She was a charter member of the Texas chapter and is at present serving on a committee to publish a library resource book for the state of Texas. Baroid maintains an extensive research library in Houston.

Jack McKay has been named manager of the sales promotion department, The Fluor Corporation, Ltd. He will be in charge of advertising, publicity, exhibits, and all phases of sales promotion. McKay joined Fluor in 1942 and for the past 8 years has been directly connected with sales, serving as a sales engineer, assistant to the director of sales, and assistant district sales manager of Fluor's Houston district sales office.

Jack McKay

Marvin M. Ramer has been promoted to contract manager at the Southwest division of chemical plants division, Blaw-Knox Company. Ramer will have charge of all contract preparations and will assist in contract negotiations for the engineering, procurement, and construction activities of chemical plants originating in the southwest division with headquarters at Tulsa, Oklahoma. He joined Blaw-Knox in 1950.

Anan Golub, secretary and controller of Mission Manufacturing Company, has been named president of the Houston Chapter, National Association of Cost Accountants, for the coming year. The Houston chapter is composed almost entirely of members from the oil and gas industries in the Gulf Coast area. Other new officers are **Emmett Day** and **Willis Davis,** vice presidents; **William Cameron,** treasurer; **R. B. Myers,** secretary; and **Riedel Wilson, W. H. Dick, Duane Ge's, W. A. Garrett, Vernon Sheffield, Norman Charleton, Ivan Oden, Fred Brewer, W. F. Spencer,** directors.

A. Golub

L. G. Porter and **Ray P. Johnson** have been elected vice presidents of Borg-Warner International, the export trade division of Borg-Warner Corporation. Porter is also treasurer of Borg-Warner and Johnson is administrative assistant to the president of Borg-Warner. **Robert A. Brown,** comptroller, has been elected treasurer of Borg-Warner International, **J. W. DeLind, Jr.,** has been re-elected president and **R. W. Dose** has been re-elected secretary.

Frank Baldwin has been released from active duty as a captain in the Army engineers in order to resume his duties as vice president of Petroleum Mechanical Development Company. Baldwin's release from active duty is in line with the army's policy of returning men to civilian life to help relieve the current acute shortage of experienced engineers in the oil industry, it was reported.

F. Baldwin

Thomas W. Simmons, Jr., has been elected president and general manager of Johnston Pump Company. According to Simmons, who was formerly vice president and general manager of the pump concern, "There will be no change in our policies or plans."

Harley M. Ross, superintendent of Carbide and Carbon Chemicals Company's Texas City plant, has been appointed assistant works manager for the company. Superintendent of the Texas City plant since 1941, Ross will move to New York City shortly to assume his new duties.

The new plant superintendent at Texas City will be **E. J. Fox,** who moves up from his present position of assistant superintendent. The following assistant superintendents for the Texas City plant have been announced: **F. H. Belden,** who was appointed assistant superintendent in March, 1947, is in charge of raw materials, gas plants, and polyethylene operations, process development, and manufacturing office. **Robert Dillon** is a new assistant superintendent replacing **Dr. C. M. Blair** in charge of chemical production units, chemical shipments, and works laboratory. Dr. Blair has been named superintendent of the new chemicals plant to be built at Seadrift, Texas.

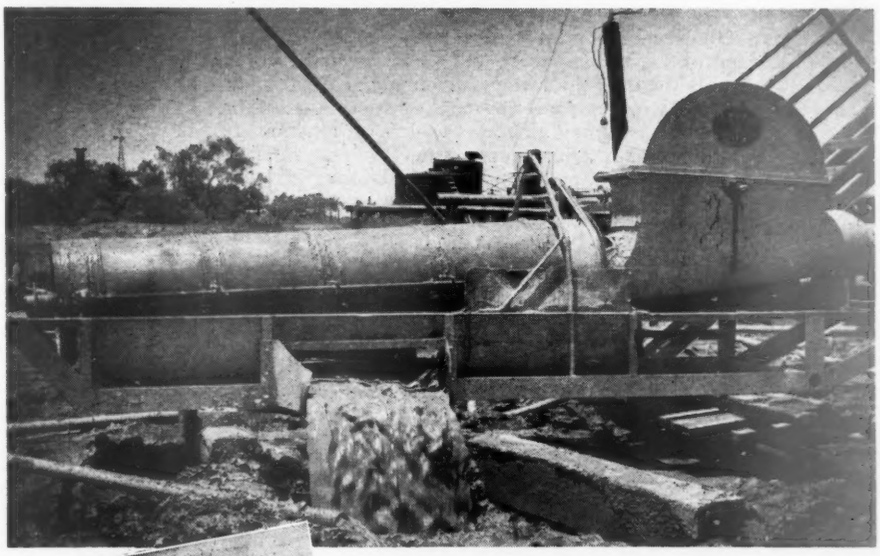
T. A. Wilker moves up to succeed **G. L. Pitzer** in charge of "Vinylite" production, "Vinylite" shipments, and the "Vinylite" laboratory. Pitzer is moving to New York to work on production problems. **H. E. Allspach** will be in charge of maintenance, utilities, works engineering, and industrial relations.

Leo M. Brown has been appointed assistant sales manager of St. Paul Hydraulic Hoist. A graduate of Ohio State University in 1938, Brown was formerly employed as a district manager serving St. Paul distributors in Texas, New Mexico, Oklahoma, Mississippi, Arkansas, and Kansas.

Edward R. Curry has been appointed to succeed Brown as South Central district manager.

Daniel J. Nadolski has been appointed manager of the Birmingham, Alabama, sales office for The Trane Company, La Crosse, Wisconsin. Nadolski was formerly associated with the St. Louis office of the company. He is an engineering graduate of Purdue University.

You'll want it for the SUPER JOB it does — for so little . . .



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No drilling outfit today can afford to be without a Thompson. The Thompson does a two-fold job and does it better: (1) it thoroughly removes the shale and abrasives from valuable drilling mud, and (2) the SAMPLE MACHINE (standard equipment on all Thompson Separators) collects foot-by-foot cuttings to give an accurate analysis of the progress of the well. Drillers as well as geologists recognize this sample machine as one of the simplest and most economical methods of obtaining true samples.

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To obtain more information on products advertised see page E-45

BOOKS

Technical Reporting, *by Joseph N. Ulman, Jr. Published by Henry Holt and Company, Inc., 383 Madison Avenue, New York 17, N. Y. Price, $4.75. Pages, 284.*

This book is addressed primarily to students and practitioners of engineering who have reached the point when they have reporting jobs to do. It is a handbook showing how to convey information and ideas accurately and efficiently, using techniques perfected by modern industry and science. The book contains material that has been used by the Massachusetts Institute of Technology for instruction in two main categories: Technical writing offered by the departments of English and history, and instruction given in collaboration with several of the professional departments: (mechanical, civil, electrical, and marine engineering, and others.) The book deals with the general procedure of report writing and attempts to show a way of correcting common errors.

The Oil Record, 1952 Edition, *published by Petroleum Industry Projects, 1420 New York Avenue, N. W., Washington 5, D. C. Price, $6. Pages, 384.*

The new Oil Record contains information on 130 oil companies and natural gas companies and their subsidiaries, for 1951. It presents detailed operating and financial data on the companies for 1951 in company-by-company reports. Information includes: Land holdings, drilling records, production, refinery throughputs, marketing gains and foreign activities. Comparison tables name companies in rank-order of their underground reserves, wells drilled, crude oil production, and runs to stills. A listing of the principal associations in the oil industry—trade groups, marketing bodies, and technical organizations with their officers' names and addresses are given.

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The Oil Producing Industry of Your State, *published by the Independent Petroleum Association of America, P. O. Box 1019, Tulsa 1, Oklahoma. Pages, 124, Copies, complimentary.*

The 1952 edition of this statistical reference book on oil and gas production contains data on 27 states. Additional information and charts on petroleum reserves, production, drilling and economic value in each state have been added to this edition. The information is reported from the date of first recorded production till January 1, 1952.

Crude petroleum and natural gas are listed among the three most valuable products in 17 states. An addition to the last published form is a section on North Dakota, which had its first commercial oil well completed only last year.

Incentive Management, *by James F. Lincoln. Published by The Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland 17, Ohio. Price, $1. Pages, 288.*

How people can develop as skillful individuals taking pride in the cooperative application of their respective skills towards making better products or giving better service is the concern in Lincoln's writing. The main spring, he believes, is incentive, and the fundamental incentive for skill is recognition and the results it achieves in higher pay, greater output, and lower prices. How we can introduce this incentive management in business is the problem which Lincoln discusses in this book. He also shows the practicability of the system by giving statistical data showing how Lincoln has decreased the prices of its products from year to year, while its workers remain in highest-paid-workers bracket.

Economics of American Manufacturing, *by Edward L. Allen. Published by Henry Holt and Company, 383 Madison Avenue, New York 17, N. Y. Price, $6.95. Pages, 555.*

A cross-section view of American industry, this book examines 19 representative industries. The five general categories are: Basic metal, basic nonmetallic, metal working, textile and allied, and consumer specialty. Included within these groups are automobiles, machine tools, aircraft, agricultural implements, leather goods, cotton textiles, synthetic fibers, food, beverages, tobacco, furniture, and other components of America's technology. The author analyses each industry from three standpoints: Its setting in national economy, corporate ownership and control, and prices and pricing policy. A concluding chapter is devoted to sources of industry data and an extensive bibliography.

Thermal Fatigue and Thermal Shock, *by Helmut Thielsch, published by the Welding Research Council as Bulletin No. 10, 33 West 39th Street, New York 18, N. Y. Price, $1. Pages, 24.*

The continuous improvement and development of many types of process equipment and installations which are exposed at elevated temperatures has resulted in a demand for engineering materials that can provide satisfactory service under increasingly severe conditions of temperature and pressure. Temperature changes may further increase the severity of the service requirements and, sometimes, may reduce seriously the life of a material. Thermal fatigue and shock, which denote the effects of temperature changes or alternating exposures at higher and lower temperatures, may be cyclic and occur at regular intervals or they may occur at irregular intervals as, for example, in the occasional or repeated shutdown of equipment which ordinarily is operated at elevated temperatures.

Handbook of Engineering Fundamentals, *by Ovid W. Eshbach. Published by John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price, $10. Pages, 1324.*

This new second edition has been completely revised in order to carry a thorough coverage of all phases of engineering. The discussions on mathematics, thermodynamics, and fluid mechanics have been entirely rewritten or revised. Similar treatment has been given to the sections on electricity and magnetism, engineering materials, and engineering law. A new section on aerodynamics has been added. The engineering tables now include standard structural sizes for aluminum, as well as data on tangents and offsets for the use of civil engineers, and the tables on standards and symbols has been brought up to date, with new tables added for surveyors. Thirty-nine scientists have contributed to this revised reference book.

Book Reviews

Index to the Reports of the National Conference on Weights and Measures, From the First to the Thirty-Sixth, 1905 to 1951, *by William S. Bussey and Malcolm W. Jensen, National Bureau of Standards Miscellaneous Publication 203. Pages, 45. Price, 20 cents. (order from Government Printing Office, Washington 25, D. C.).*

The reports of the proceedings of the National Conference on Weights and Measures published since 1905 contain a large amount of information on a wide variety of weights and measures subjects. For ease of reference, the index is published in two forms: a subject index and an index by names of speakers. Careful cross-indexing enables those using the subject index to find the desired information under either principal or associated words. In the name index, the names of speakers are arranged alphabetically; and in chronological order under each name appear references to the papers or addresses presented to the various conferences by that speaker. In those instances in which a speaker's official or business connection has changed during the period covered by the index listings, his name is entered once for each such connection; an appropriate listing of papers or addresses appears under each of these entries.

Principles of Petroleum Geology, *by E. N. Tiratsoo. Published by McGraw-Hill Book Company, 330 W. 42nd Street, New York 36, N. Y. Price, $7.50. Pages, 435.*

"Principles of Petroleum Geology" covers both the academic questions related to the origin, migration, and accumulation of petroleum in the subsurface, and the practical problems of discovering and exploiting oil deposits. These include surface methods such as geological mapping, aerial survey, and the evaluation of oil seepages and asphalt deposits; and also subsurface methods of discovery, and the integration of physics and geochemistry with geology for this purpose. The world's oil fields are reviewed, particularly with reference to their structural and stratigraphic history. The latest techniques of exploitation geology are described, and there is a special chapter devoted to the technology of drilling fluids. The book begins with the probable processes of the origin and accumulation of oil, followed by an illustration of these principles, then by a discussion of the chief oil fields of the world.

The Petroleum Dictionary, *by Lalia Phipps Boone. Published by University of Oklahoma Press, Norman, Oklahoma. Price, $5. Pages, 332.*

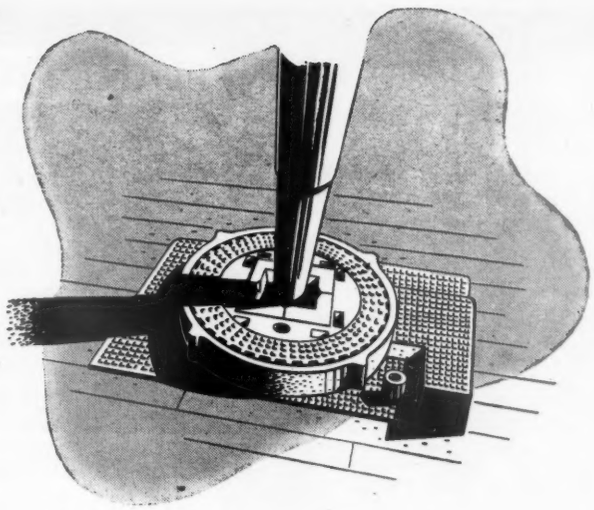
The Petroleum Dictionary will serve the needs of anyone associated with the petroleum industry. Included in this reference volume are more than 6000 words and expressions, technical and non-technical, which make up the everyday language employed in the petroleum industry. To these definitions have been added the names and nicknames of towns, fields, wells, oilmen, companies, and geological formations which have arisen from the expressions which characterize the industry itself. Of the 6000 words, more than one-third are recorded for the first time, as words or expressions native to the industry. The definitions were formulated with the aid of technical men, and from interviews with the workers in the various producing fields in the United States.

Guidebook, Joint Annual Meeting AAPG, SEG, and SEPM, *Los Angeles, California, March, 1952. Published by Pacific Section, AAPG, Rufus Smith, Secretary, Continental Oil, Edison Building, Los Angeles 17, California. Price, $6.50. Pages, 290.*

Short illustrated papers on sixty-five California oil fields, as well as several papers on regional geology are contained in this guidebook. There are 88 maps, 83 cross-sections, 29 stratigraphic or correlation charts, and 11 photographs for illustration. There are also road logs of 670 miles of roads.

Practical Preventive Maintenance for Gas and Diesel Engines, *published by The Cooper-Bessemer Corporation, Mount Vernon, Ohio. Price, $2.*

Cooper-Bessemer's preventive maintenance program is detailed in its two newest manuals. One manual covers gas-diesel and diesel engines; a second manual covers gas engines. In contrast to the usual periodic 8000-hr overall check or the progressive-type maintenance schedule, Cooper-Bessemer's manuals show how to perform continuing checks on engines while in service to accurately forecast internal conditions of the engines and anticipate operational needs.



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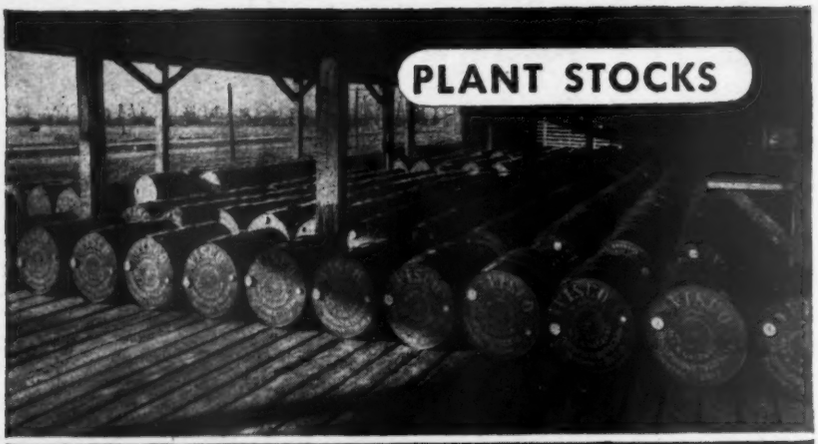

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New Machinery and Supplies

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Circle corresponding letter or letters on reply card.

(A) DOZER DESIGN

Unusual portability is one of the features of the Allis-Chalmers, Baker 9-X dozer. Only 96 in. wide from tip to tip, the 9-X tractor-dozer fits on any truck or trailer for on-highway hauling —without special permit. High-yardage dozing capacity of the blade is made possible by its extra height—approximately the capacity of the wider blade normally used on the A-C HD-9 tractor.

Circle letter (A) on reply card.

(B) PLASTIC GLOVES

Plasticote Glove Company announces the addition of the Plasti-Grip glove to their line. The Plasti-Grip glove is especially effective for work in oils, greases, and lubricants. The rough surface of this plastic has in it numerous inert particles of material which grip the most slippery objects. In addition to its high gripping power, Plasti-Grip gloves have resistance to most chemicals, acids, and alkalis. It has high abrasion resistance, and remains flexible at low temperatures. Plasti-Grip gloves are available in all styles. The coating on these gloves is Vinylite brand resins, a trade marked product of the Bakelite Company.

Circle letter (B) on reply card.

(C) STEAM TRAP

Velan Engineering Company has announced a new and unique design in its Velan steam trap. It is the type SP a piston operated steam trap for applications where exceptionally large capacities are required. This new trap being comparatively small and 3 to 10 times lighter than other designs of similar piston-operated traps has a 2 in. orifice with tremendous capacities. It combines the Velan 4 operation principle: Airvent, strainer, condensate discharge, and check valve. All moving parts are made from stainless steel.

Circle letter (C) on reply card.

(D) BLIND RIVETING

Huck Manufacturing Company announces a new angle adapter, which expands the scope of blind riveting to many additional assembly and maintenance applications. This angle adapter, when used in conjunction with either a Huck hand riveting tool or an air riveting tool, simplifies assembly of previously inaccessible deep channels, hard to reach corners, and otherwise impossible to rivet locations. One person from one side of work can now drive Huck ⅛-in., 5/32 and 3/16-in. diam self plugging or pull through blind rivets in a clearance space of only four inches from nose of riveting tool to back face of angle adapter.

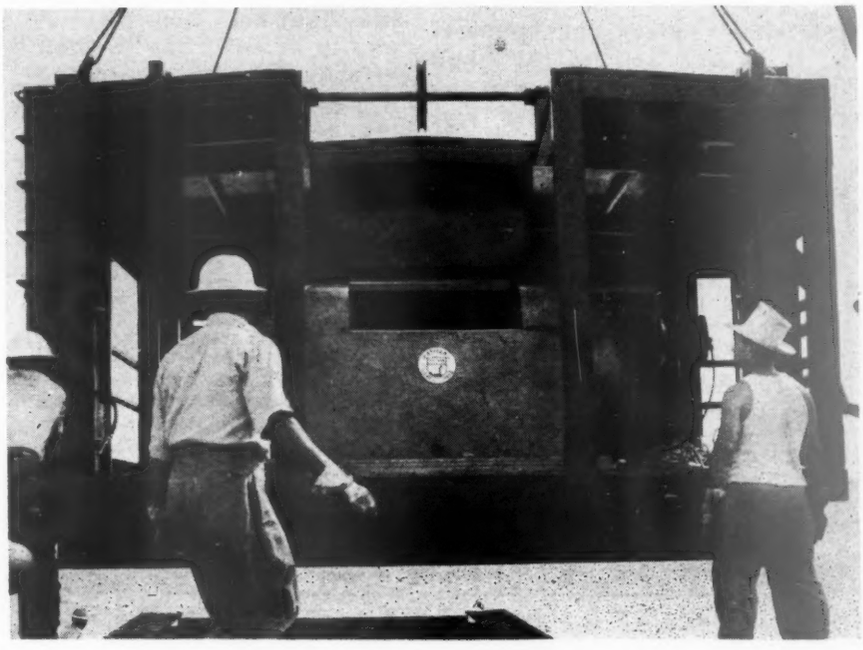
Circle letter (D) on reply card.

(E) DRILLING RIG

An Ideal T-12 rig, a compact and portable unit designed primarily for drilling and servicing on land, has been adapted to marine use by the Creole Petroleum Company in the Tia Juana district of Lake Maracaibo, Venezuela. Completely housed with walkways, flooring and roofing, to suit it to this special purpose, the rig was picked up by a 20-ton whirly crane mounted on a seagoing tug, and delivered to the well site. A 24-ft base derrick, with a 14-ft cantilever extension on each side, and a floor level approximately 20 ft above the water level, is erected for original drilling of the well and is left in place over the completed well for servicing operations. The Ideal T-12 rig was introduced by The National Supply Company in 1950. It is designed especially for shallow drilling, medium depth servicing, and workover jobs.

Circle letter (E) on reply card.

National Supply's new Ideal T-12 rig.



(F) CHECK VALVES

James-Pond-Clark have developed two check valves, the 800 series and the 8800 series. These valves incorporate the basic advantages of a poppet design with the operating characteristics of a swing check valve. Extremely low cracking pressure and pressure drop have been achieved without sacrificing the characteristic dead tight sealing, the company reports. The valves are suitable for engine oil, hydraulic fluid, air, carbon dioxide, helium, nitrogen, etc.

Circle letter (F) on reply card.

(G) AUTOMATIC TANK GAGE

A new automatic liquid level gage for low pressure storage tanks has been developed by The Vapor Recovery Systems Company. Designated as the Fig. No. 2500, it incorporates a full-view, direct reading counter in the look box for quick, accurate reading of foot increments and a dial for reading inches and fractions of tank contents. The Neg'ator Motor (patented) housed with the gage head, maintains a predetermined constant tape tension. This eliminates the need for the conventional counterweight. Installation of look box may be made at any desired height.

Circle letter (G) on reply card.

(H) WATER CONDITIONER

The Pur-O-San Company, a division of Bradford Chemical Company, announces Pur-O-San Extra for use in heat exchangers and condensers. According to company officials, extensive field and laboratory tests have proved Pur-O-San Extra to be a complete conditioner for treating water used in heat exchangers, and readily soluble and providing full protection regardless of the characteristics of the water used.

Circle letter (H) on reply card.

(I) PORTABLE COMPRESSOR

Ingersoll-Rand rounds out its line of Gyro-Flo portable compressors with three sizes in addition to its 600 cu ft per minute model. The introduction of 315, 210, and 105 cu ft per minute units makes the advantages of the rotary sliding-vane design available for a wide range of operating requirements. Major benefits claimed by the manufacturer are simplicity and low cost of operation and maintenance, and greater reliability.

Circle letter (I) on reply card.

(J) MULTI-SPEED UNIT

The Turner Machinery Company announces three new models of multi-speed power units for heavier horsepower applications. Models 2004, 3004, and 5004 transmissions are the result of over two years of design, engineering, and test operation. The models are available in ratings up to 60 hp.

Circle letter (J) on reply card.

(K) PORTABLE PIPE LINE

A new portable fuel supply "pipe line" has been developed by The B. F. Goodrich Company in cooperation with the engineer research and development laboratories of Fort Belvoir, Virginia. Intended for delivery of gasoline and other liquid fuels to forward dispensing points, the developmental hose line may in the future provide means for rapidly transporting bulk supplies in the quantities required by combat elements of the Armed Forces. Tests indicate that this type of "pipe line", consisting of the world's lightest weight gasoline hose, can be laid from a vehicle at rates up to 15 miles per hour.

Circle letter (K) on reply card.

(L) BATTERY POWER REGULATOR

Beckman Instruments, Inc., has announced a new battery power regulator that assures sustained accuracy and minimum battery maintenance when making measurements with Beckman Model DU spectrophotometers. This new accessory permits the operator to exercise precise control in regulating the charging unit so that the battery can be supplied with the exact amount of current needed for operating the instrument. A unique feature of this new regulator is that it enables the operator to make an accurate determination of the total current being consumed by both the Spectrophotometer and the tungsten lamp.

Circle letter (L) on reply card.

(M) PHOTOMULTIPLIER

Beckman Instruments, Inc., has announced the development of a new photomultiplier attachment that greatly increases the sensitivity of Beckman

Model DU Spectrophotometers — particularly in the 200 to 600 millimicron range. With this new attachment it is now possible to obtain an overall amplification gain from 100 to 1000 times that of the standard ultra-violet sensitive phototube. Resolution of the instrument is greatly increased in all spectrophotometric measurements, but particularly in flame, fluorescence, and turbidimetric determinations.

Circle letter (M) on reply card.

(N) ANCHOR CLAMP

The S & S Specialties one bolt stand pipe anchor clamp is made in only one size. It fits 4 in. stand pipe and will fit any make of standard derrick regardless of height. The clamp has been field tested and has been found to positively eliminate all rattles and vibration. The clamp is an electric steel casting carefully machined of the best material. The S & S Specialties stand pipe clamp is a safety measure and can be put up and taken down in a matter of minutes. It will last a life time and it comes in sets of three, but can be used separately.

Circle letter (N) on reply card.

(O) EQUILIBRIUM COMPUTER

Beckman Instruments is now producing an advancement in the field of instrumentation — the Beckman phase equilibrium computer. This instrument is of particular interest to petro-chemical and petroleum processors because it greatly simplifies the handling of vapor-liquid calculations, permitting technically-trained personnel to solve a much greater volume of vapor-liquid relationships in only a fraction of the time required by conventional methods.

Circle letter (O) on reply card.

(P) ALCOHOLS, GLYCOLS

Air Reduction Chemical Company, the recently formed division of Air Reduction Company, Inc., has announced the availability of a group of tertiary acetylenic alcohols and glycols.

The chemicals just announced are available in drum quantities. These chemicals are: methyl butynol, methyl pentynol, dimethyl hexynediol, and dimethyl octynediol. Immediate uses are two. A new non-habit forming sleeping drug takes advantages of the hypnotic properties of methyl pentynol. Dimethyl hexynediol provides an alternate starting point for the involved allethrin synthesis replacing the usual methallyl chloride.

Circle letter (P) on reply card.

This Plant Claims Their

HEAT SAVINGS PAID for NICHOLSON TRAPS

Nicholson expansion steam traps were installed by a processor on tank heaters and coils where various unit temperatures from 160° to 185°F had to be maintained. The steam temperature was 320°F. Figuring the difference in heat loss between Nicholson traps discharging condensate at 160° and others discharging it at about steam temperature, they feel heat loss was cut nearly in half. Due to their effectiveness in controlling temperature as well as draining condensate, Nicholson traps are paying for themselves in many industries.

FOR ALL EQUIPMENT USING STEAM OR HOT WATER

CATALOG 751 OR SEE SWEET'S

Absorption Stills, Agitators, Evaporators, Gas Holders, Heat Exchangers, Heavy Oil Tanks, Kettles, Petroleum Tanks, Pipe Coils, Radiators, Reboilers, Steam Stills, Tar Tanks, Wax Tanks

217 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

(Q) EXTRUDED TUBES

New equipment that will make available as tubing for the first time a large and important field of unpierceable metals has been installed by The Babcock and Wilcox Company. The equipment that went into operation experimentally in December was the subject of a recent progress report announcement to the metal industries. As an example, with the new B&W equipment a white hot billet of selected metal, 28 in. long and 8 in. in diameter can be extruded, or "squeezed out" like toothpaste, into a 60 ft tube, 2 in. in diameter in less than 5 sec.

Circle letter (Q) on reply card.

(R) ACID-PROOF HOSE

A new rubber hose just developed in the research laboratories of the Hewitt rubber division of Hewitt-Robbins Inc., gives promise of resisting concentrated organic and inorganic acids. "In the past," said Clayton H. Skinner, technical superintendent at the Hewitt rubber division, "previous recommendations on the use of hose in conveying acids were limited to these maximum concentrations: Sulfuric 50 per cent, nitric 10 per cent, acetic 10 per cent, hydrochloric 80, and hydrofluoric 50 per cent.

Circle letter (R) on reply card.

(S) TRUCK CRANE

Harnischfeger Corporation has announced a new truck crane, symbolized by "Miti-Mite", a small powerful man. The crane is designed exclusively for truck service and is not an adaptation of a crawler excavator. It is said to be readily convertible for any front end service—shovel, trench hoe, drag line, clamshell, crane, and magnet crane, etc. It has a ⅜-cu yd capacity as shovel and 7-ton capacity as crane. Notable among the many features of the new crane is its power box design. This new concept of crane design provides a single, compact box to contain all driving machinery.

Circle letter (S) on reply card.

(T) ROTARY JAR

A smaller-version of the Bowen-Itco hydraulic rotary jar, this new tool incorporates the same principles used in the larger jars, plus a versatility not found in conventional tools of this type. The Bowen rod jar can be run on either wire line or sucker rod. It can be made to hit any desired blow at the will of the operator. It can be rotated, or by the simple removal of a pin through the washpipe, it will swivel. This tool has been used successfully in swabbing operations, bailing, fishing, and coring.

Circle letter (T) on reply card.

(U) CENTRIFUGAL COMPRESSOR

A new centrifugal compressor has been developed by the Sawyer-Bailey Corporation, for handling gases in high pressure systems operating at 600 psi and higher. An outstanding achievement in the design of this compressor is its ability to operate efficiently at flows as low as 125 cu ft per minute. A built-in lubrication system insures an oil free flow of gas, as the impeller requires no lubrication.

Circle letter (U) on reply card.

(V) CARBON DIOXIDE EXTINGUISHERS

A built-in device that grounds static electricity and eliminates shock to operators of carbon dioxide fire extinguishers having hose connections, is announced by American-LaFrance-Foamite Corporation. It is the Alfco Anti-Statik horn. The discharge from a carbon dioxide extinguisher is largely carbon dioxide snow, and it issues from the nozzle at a high velocity creating friction against the inside of the horn. This friction produces a charge of static electricity that builds up in the plastic horn, which being a non-conductor, acts as a condenser.

Circle letter (V) on reply card.

(W) FLOW RULE

Two essential tools in flow meter engineering, the Foxboro flow rule, which simplifies calculation of primary elements, and "Principles and Practice of Flow Meter Engineering," recognized as a basic text on fluid measurement, are now being offered in a combination purchase by The Foxboro Company. Specially designed for rapid solutions to problems of line size, flow rate, and orifice sizing, the Foxboro flow rule has a reversible slide with scales for gas on one side, liquids and steam on the other, each fluid identified by a distinctive color. Accuracy of the flow rule is closer than can be read. Over-all length of the rule is 12 in. Complete instructions and cowhide carrying case are included.

Circle letter (W) on reply card.

(X) PUMP TEST STAND

The De Laval Steam Turbine Company has recently completed the first 12 months of operation of several new pump test stations. A detailed analysis of all test data to date has shown a direct reduction in testing time and a saving in man hours that has effectively cut testing costs by 75 per cent. These stands are engineered to give a complete reproduction of performance for pumps of all sizes and ratings. The test engineer has no need for a variety of tools on these test stands. They are permanent installations consisting of a double-ended dynamometer mounted on an automatic life between two pre-aligned pump bedplates.

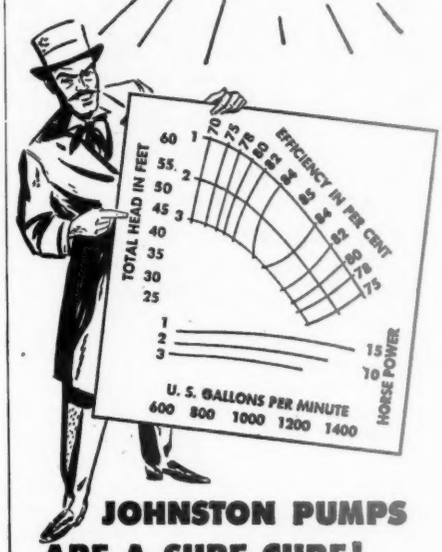
Circle letter (X) on reply card.

(Y) PIPE COUPLING

A factory assembled pipe coupling that can be installed in any piping system in less than 60 sec is announced by Quik-Joint Manufacturing Company. No thread cutting whatever is required. Pipes to be connected are inserted into the ends of Quik-Joint coupling body and the lock nuts wrenched to desired tightness. The result is a tightly sealed but flexible joint capable of withstanding working pressures up to 2000 psi. No castings are used; the body is of pressure-tested pipe steel.

Circle letter (Y) on reply card.

Suffering from
Horsepower Headaches?

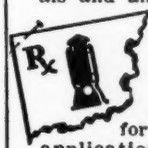


JOHNSTON PUMPS ARE A SURE CURE!

Don't blow a fuse because you are overloaded with pumping troubles. The steep head-capacity and flat horsepower characteristics of Johnston Vertical Turbine Pumps prevent overloading of the motor regardless of fluctuations in capacity or head. Low starting torque requires less horsepower and results in higher efficiency and longer life of the motor.

The Treatment Is Painless

Every Johnston Pump is engineered for the specific duty for which it is intended. Trained hydraulic engineers are available at your nearest Johnston dealer or at the Johnston factory to furnish detailed information, proposals and anything else necessary to cure your particular pumping malady.



The Johnston Wonder Drug

Johnston Turbine Pumps are ideally suited for industrial and municipal applications because of their non-overloading characteristics, simplicity of construction, compactness, ease of installation, elimination of priming, low starting torque, capacity adjustment features and minimum maintenance costs.

Free diagnosis!

No matter what your pumping job, contact your nearby Johnston Dealer or write the factory direct for a free diagnosis of your pumping headaches.

JOHNSTON PUMP COMPANY
3272 EAST FOOTHILL BLVD., PASADENA 8, CALIF.
Headquarters for Vertical Turbine, Mixflow and Propeller Pumps Since 1909

(Z) ROUND-CHART RECORDER

The Bristol Company announces the addition of round-chart recorders and automatic controllers to its line of electronic Dynamaster potentiometers and bridge instruments. The new round-chart Dynamaster models are said to be high-speed, continuous-balance, null-type electronic instruments that can be used to measure any variable that can be translated into an electrical quantity such as d-c current, d-c voltage, capacitance, or resistance.

Circle letter (Z) on reply card

(AA) GASKETS

Teflon is now being used successfully in the spiral-wound gasket construction, for process applications where extreme inertness to chemicals is important, according to an announcement by Flexitallic Gasket Company. The gasket construction consists of alternating plies of Teflon and stainless steel. Chief advantage of this gasket is said to be the elimination of cold-flow normally encountered in a Teflon seal. Trapped between edges of metal, the Teflon cannot flow when bolting is applied.

Circle letter (AA) on reply card.

(AB) HEAVY-DUTY CHASSIS

A new model Sterling-White chassis developed for oil field operations and other heavy-duty services has been announced by the White Motor Company's Sterling division. This Sterling-White, model SB 3255D, is engineered for the rugged service of handling drilling rigs and other heavy oil field machinery. A 200 hp diesel engine provides the power for this new model. Dual transmissions, a four speed main and three speed auxiliary, give the operator a wide selection of gear ratios, enabling the truck to perform under all operating conditions.

Circle letter (AB) on reply card.

(AC) PIPE FITTINGS

Milex pipe fittings molded of tough Tenite plastic by Tenco, Inc., are now available in ½-in. to 4-in. sizes and in a variety of clear transparent or black tee's, elbows, laterals, and other couplings. Easy to install, these lightweight fittings may be quickly and permanently joined to Tenite pipe by means of a cement and solvent. Milex has also developed special flange unions and flange adapter unions for joining Tenite to Tenite and Tenite to steel. Colors other than black are available on special order. Tenite is a product of Tennessee Eastman Company, Division of Eastman Kodak Company.

Circle letter (AC) on reply card.

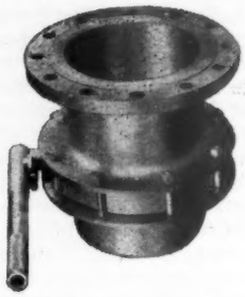
(AD) DRILL PIPE COMPOUND

A new drill collar and tool joint compound has been developed by Armite Laboratories, which the manufacturer asserts definitely prevents the seizing and galling of threads on these tools. Known as Compound 500, this material is basically a pure metallic lead compound in a consistency for easy application to drill collars, drill pipe and bits.

Circle letter (AD) on reply card.

(AE) BUTTERFLY VALVE

Designed for maximum pressures of 150 psi, Keystone butterfly valves are recommended for use on drilling mud lines, salt water disposal systems, suc-



tion lines, flow lines and in vacuum service. Great flexibility is provided by the unique design, which permits any combination of welded, flanged, or screwed ends to be used interchangeably on the main body element. The bolted assembly permits quick removal and replacement of the ends and also permits the body element, which contains the seat and sisc, to be removed from the line by removing a portion of the flange bolts.

Circle letter (AE) on reply card.

(AF) ELECTRIC SWITCH

A new compact, weather and oil-proof push button electric switch was announced by Micro Switch, division of Minneapolis-Honeywell Regulator Company. Weighing only an ounce, the double-pole, double throw assembly is so small it will fit inside a walnut shell. The panel-mounted push button is sealed against the entrance of oil, water, and dirt by synthetic sponge rubber. The small movement required to operate subminiature snap-acting switches is provided by resilience of the seal. No sliding joints are required.

Circle letter (AF) on reply card.

(AG) NIPPLE CHUCK

A Universal nipple chuck (Beaver "55") capable of threading ⅛ to 2-in. pipe has recently been introduced to the market by Beaver Pipe Tools, Inc. This new Universal nipple chuck has but three parts . . . a polished steel body, a sliding plunger, and a hardened steel threaded shank. Nipples are easily removed by hand . . . no wrenches required. Adapters allow for all sizes from ⅛ to 1½-in. pipe. No adapter is needed for 2-in. pipe.

Circle letter (AG) on reply card.

(AH) FIRE EXTINGUISHERS

Safety First Products Corporation recently set fire to a 10,000 gal oil tank to try out the new Safety First dry chemical hand portable fire extinguishers. Five men, most of them inexperienced in fire fighting, and equipped with only 25 and 30 lb Safety First extinguishers, put out the fire 8 sec later, with only one half of the dry chemical expelled to do the job. In two other demonstrations, these men completely put out gasoline primed oil fires in water filled sumps in less than 5 sec with the same extinguishers.

Circle letter (AH) on reply card.

(AI) WELDING UNITS

This specially designed gantry for semi-automatic welding units features a rapid, tri-directional adjustment for the welding gun. An added feature of this fixture, which is carried in Hillco, Inc., stock, is the easy access the operator has to all welding machine controls because the entire unit fits compactly on a caster stand beside the operator. All circumferential welds from practical minimum to 54 in. in diameter can be made with the standard rack.

Circle letter (AI) on reply card.

(AJ) FIXTURE HANGER

Crouse-Hinds Company has developed a new explosion-proof fixture hanger meeting the requirements of Underwriters' Laboratories, Inc., and the National Electrical Code. The new type EFHC explosion-proof hanger is essentially a T fitting, the top two through-feed hubs for the lighting circuit conduit and the bottom hub for the fixture stem. A threaded cover is provided at the side of the hanger.

Circle letter (AJ) on reply card.

(AK) LIMITAMP

A new design of refinery-type limitamp (Class I, Group D, Division 2), smaller in physical size and lower in price than former models, has been announced by the General Electric Company's control department. According to company engineers, the use of a new manually-operated, oil-immersed, explosion-proof disconnect switch in the primary circuit of the control transformer has eliminated the additional cubicle previously required for control power. This, plus a shallow enclosure, they said, permits a 60 per cent reduction in the size of the unit.

Circle letter (AK) on reply card.

(AL) WIRE LINE JAR

S. R. Bowen has developed a new wire line jar, which is run with wire line fishing tools, to enable the operator to strike heavy upward blows against an obstinate fish and knock it loose. These jars are also installed as safety devices in strings during all types of wire line operations, such as swabbing, coring, bailing, etc. Their presence insures the operator of the ability to knock the tools loose should they stick. The top sub, bowl, and knocker sub comprise a rigid unit that is connected with another rigid unit consisting of the piston, friction mandrel, main mandrel, and bottom sub.

Circle letter (AL) on reply card.

(AM) CEILING FIXTURES

Crouse-Hinds Company has developed a 200-watt explosion-proof lighting fixture for flush mounting in ceilings. The type RCDE-8 fixture is available with an 8-in. lens with symmetrical lighting distribution for general illumination or with prismatic lens with asymmetric distribution for special applications. The fixture with symmetrical general lighting distribution is suitable for use where appearance is an important factor, where headroom is limited, etc.

Circle letter (AM) on reply card.

Trade Literature

Publication will be sent free.

(AN) REPORTING FORMS

New Kraftbilt production reporting forms Catalog 152 is now available from the Ross-Martin Company. Catalog 152 is the product of an intense 6-month project just completed by the Ross-Martin research department. This study of the business forms and methods used by the oil industry in recording oil production today, guided staff forms design engineers in their development of the new line of Kraftbilt standard forms. Gage reports, well test forms, production summary and audit forms, and pipe line run tickets are illustrated full-size with specimen entries and detailed comments.

Circle letter (AN) on reply card.

(AO) WHEEL TRENCHLINER

Parsons Company recently issued a colorful 4-page catalog describing outstanding features of the new Parsons Model 202 Trenchliner. This is a wheel-type digging unit, designed primarily for drainage and utility trenching work, with a maximum digging capacity of 18½ ft per minute, according to the manufacturer. Full crawler mounted, the Parsons 202 Trenchliner is equipped with either square or round bottom buckets that cut trenches 13 to 31 in. wide, to a maximum depth of 6 ft.

Circle letter (AO) on reply card.

(AP) PLASTICIZERS

Pittsburgh Coke and Chemical Company's plasticizer division has prepared an illustrated 14-page booklet describing its complete line of high quality plasticizers. The brochure is divided into three main parts: "Plastics . . . an Industry Comes of Age," "The Story of Pittsburgh PX Plasticizers," and a special section on the uses and properties of 10 individual plasticizers offered by Pittsburgh Coke and Chemical. A complete list of Pittsburgh Coke and Chemical's products is given on the inside back cover.

Circle letter (AP) on reply card.

(AQ) ROLLER CHAIN

A new 148-page roller chain engineering data book No. 2457 has just been published by Link-Belt Company and is now available. It is one of the most comprehensive books ever developed on roller chain and its application. Detailed engineering information covers the selection, installation, lubrication, and maintenance of roller chain for drives and conveyors, and sprocket wheels. For reference and easy identification, the book contains a large number of photographs and line drawings.

Circle letter (AQ) on reply card.

(AR) FORK LIFT TRUCK

The Buda Company has issued a copy of a new bulletin No. 1570, which describes the company's completely modern diesel or gasoline powered "FT" series fork lift trucks available in capacities from 3000 lb to 7500 lb. The bulletin is thoroughly illustrated, containing line drawing, tables, and charts describing the new fork lift trucks, which have all controls in front.

Circle letter (AR) on reply card.

(AS) GAS-GASOLINE

The Continental Supply Company has published a 4-page bulletin on a new product, its automatic gas-gasoline control, made for use with all three models of the CSCO pumping engine—the C-46, C-66, and C-96. The new control is said to mix gasoline with gas to maintain needed power when gas is in short supply. When gas is in full supply, it shuts off gasoline, operating on gas alone, the company states. The new equipment is fully automatic, and one adjustment serves all loads and speeds.

Circle letter (AS) on reply card.

(AT) AIR INTERCOOLERS

Young supercharger air intercoolers, designed for cooling compressed air between the supercharger blower and the air manifold leading to cylinders of engines—diesel, natural gas, dual fuel, etc.—are described in a new Catalog No. 1652, released recently by the Young Radiator Company. The four-page, two-color catalog describes the two types of supercharging systems now in common use with 4-cycle engines—the low and high pressure systems.

Circle letter (AT) on reply card.

(AU) RUBBER PRODUCTS

The Goodyear Tire and Rubber Company has published a new 20-page catalog entitled "Rubber Products for the Oil Producer and the Oil Refiner." This brochure, which is fully illustrated, is designed to aid the oil man in choosing the proper types of materials to obtain greatest service at lowest cost. Every product described has its own application—and is specifically engineered for an individual job or operation.

Circle letter (AU) on reply card.

(AV) GAS PULSATION

A survey and analysis of gas pulsation problems in a major petroleum processing plant, describing how these problems were solved by the installation of snubbers, has been compiled by the Burgess-Manning Company. The four page pamphlet describes how excessive pulsation causing vibration and noise in the discharge piping from gas driven compressors was reduced by installation of snubbers.

Circle letter (AV) on reply card.

(AW) TRACTOR MAINTENANCE

Prevent Down Time, urges Caterpillar Tractor Company in the title of a new booklet. Preventive maintenance, subject of the booklet, has been likened to preventive medicine—both try to reach the "patient" in time to avoid trouble. Illustrations show how the Caterpillar dealer offers complete facilities for the maintenance of equipment. Earlier booklets of the same series tell how the operator himself can take steps to forestall needless breakdowns. The maintenance program includes routine care by the operator plus expert help from the dealer.

Circle letter (AW) on reply card.

(AX) DRILLING CHART

A simplified, easy-to-read rotary drilling wire rope cut-off chart has just been made available to oil field operating men by A. Leschen and Sons Rope Company. The chart is printed on heavy, plasticoated stock, punched at the top for convenient hanging. It shows approximate lengths of rope to cut, at the proper intervals, according to rope size, drill pipe size, excess weights, and depth of hole.

Circle letter (AX) on reply card.

(AY) CROSS INDEX

Bulletin Index 100-A, an index of technical literature available from Honeywell's industrial division, has been published by Minneapolis - Honeywell Regulator Company. It consists of both a numerical listing and alphabetical cross index for specification sheets, instrumentation data sheets, catalogs and other literature. Included in the alphabetical index, are articles from "Instrumentation" the manufactures quarterly publication.

Circle letter (AY) on reply card.

(AZ) HEAVY EQUIPMENT

For the first time in the heavy machinery field a comprehensive guide illustrating the use of tractor-mounted tools in all basic industries such as railroading, construction, light and heavy logging, farming, mining, oil and gas and governmental projects, has been released. Entitled, "A story of Tractor Tools and Their Uses", it is published by Hyster Company. Printed in four colors, the brochure uses an unique cartoon-style, which presents many of the principle uses for this type of equipment.

Circle letter (AZ) on reply card.

(BA) CABLE REEL JACKS

Cable reel jacks for lifting and holding heavy reels are featured in a new two-page bulletin published by The Duff-Norton Manufacturing Company. Designed for handling cable reels from 20 to 90 in. in diameter, these jacks are available in capacities of 5, 10, and 15 tons. Four types of cable reel jacks are illustrated and described in the bulletin: Three hook ratchet reel jack, mounted on an oak "T" frame base; four hook ratchet reel jacks, with extra long lifting racks; ratchet reel jacks with hooks adjustable in height; and screw type reel jacks, with steel "A" frame base.

Circle letter (BA) on reply card.

(BB) SOLENOID VALVES

The complete new line of "Shear-Seal" solenoid valves—shut-off, 2-way diverter, 3-way selector, and 4-way selector—is covered in the Barksdale valves Catalog 1B-2 along with illustration and description of the "Shear-Seal" principle. Valves for air, water, and oil service come in three groups of pressure ranges—0 to 250 psi, 0 to 1500 psi, and 0 to 3000 psi.

Circle letter (BB) on reply card.

(BC) SAFETY DEVICES

A new 24-page catalog has been published byMcDonnell and Miller, Inc., which is designed primarily as a workbook to help in the selection and application of the company's safety devices for steam and hot water boilers, and heaters. Included are the many specialized variations adapted for original equipment use, plus various components as they have been utilized for liquid level control applications.

Circle letter (BC) on reply card.

(BD) AIR CONDITIONING FILTERS

A new 8-page illustrated bulletin describing the improved Staynew ventilation and air conditioning filters has been announced by the Dollinger Corporation. The bulletin contains specifications, engineering, and performance data covering various types of filters recommended for the removal of dust and other foreign matter by the impingement method.

Circle letter (BD) on reply card.

(BE) IRON CASTINGS

International Nickel Company, Inc., has announced a new glossary of terms for producers and users of iron castings. The 36-page bulletin explains more than 150 technical terms that are used in common between suppliers and users of ferrous and non-ferrous castings. It is offered to increase the mutual understanding that promotes greater accord in working out the procurement of satisfactory and improved castings.

Circle letter (BE) on reply card.

(BF) SCIENTIFIC INSTRUMENTS

The current issue of *News Chats*, published by Central Scientific Company of Chicago, contains interesting articles as well as up-to-the-minute news about new developments in scientific instruments and laboratory apparatus. *News Chats* is published four times a year.

Circle letter (BF) on reply card.

(BG) AIR-CONTROLLED PUMP

The Milton Roy Company has announced a new Bulletin, No. 351, covering the company's line of air-operated pumps and systems. The 24-page, 2-color bulletin gives complete details of construction, operation, and application. Cutaway views of the pumps and illustrated diagrams of controls and typical air-powered systems are used to clearly describe the method employed to harness air for controlled volume pumping.

Circle letter (BG) on reply card.

(BH) GLUCOSATES

D. W. Haering & Company, Inc., have just issued a new booklet announcing a new way to buy glucosates. The company will now sell its various glucosates, which are a corrective for corrosion and scale, in drums ready to use. The booklet tells the particular use each glucosate has in the correction and control of corrosion, scale, and algae. This will apply to all their glucosates.

Circle letter (BH) on reply card.

(BI) SPIRAL PACKINGS

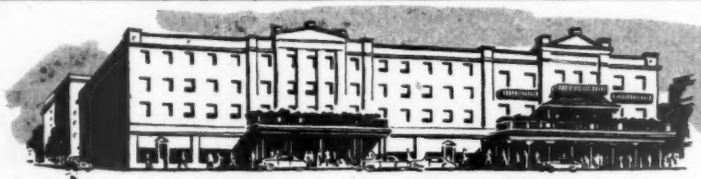
The Durametallic Corporation's "Handy-Pack" package of general purpose packing is effectively illustrated and described in a new bulletin just off the press. The bulletin explains that the "Handy-Pack" package consists of a convenient combination of Durametallic and Dura plastic spiral packings ready for cutting into stuffing box rings. Lead foil packing is designated "Type AB" and aluminum foil "Type DD".

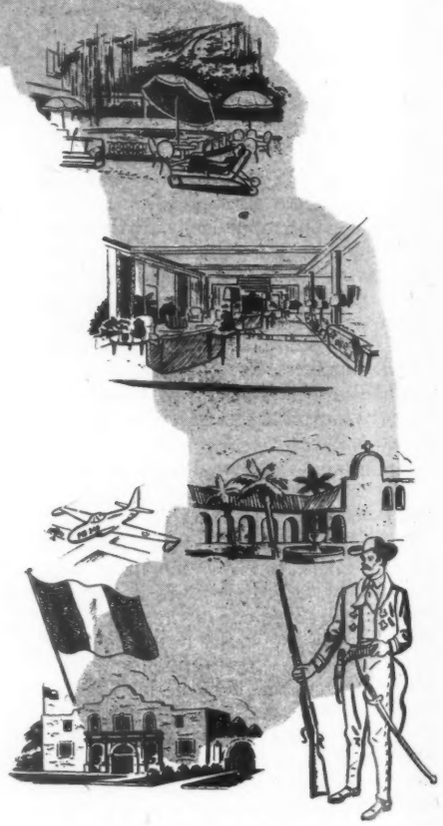
Circle letter (BI) on reply card.

(BJ) COMPRESSORS

A new 4-page bulletin descriptive of all types of 105 cu ft per minute Davey compressors, is announced by Davey Compressor Company. Davey gasoline, diesel, and electric-powered trailers; "Auto-Air" truck-mounted units and industrial stationary machines are listed and illustrated in detail. Complete mechanical specifications are included in a handy reference table.

Circle letter (BJ) on reply card.





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HOTEL LUBBOCK.....Lubbock
HOTEL FALLS.....Marlin
HOTEL CACTUS.....San Angelo
HOTEL MENGER.....San Antonio
ANGELES COURTS.....San Antonio

VIRGINIA
HOTEL MOUNTAIN LAKE ... Mountain Lake
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(BK) PRECISION COMPONENTS

New 16-page illustrated brochure, MDA-200, describes the complete line of precision components for rapid and economical breadboard and semi-permanent assembly of control systems instrumentation and analog computers. In addition to the previously standard articles the brochure features a greatly expanded line of new mechanical development apparatus components. The new components include: Lead screw unit, clutch, bevel gears, etc.

Circle letter (BK) on reply card.

(BL) STAINLESS STEEL

Allegheny Ludlum Steel Corporation has published a 34-page bulletin on Allegheny steel in the petroleum industry. It discusses stainless steel in the crude oil field, oil refining industry, cycling and natural gas, oil transportation and storage, and in the marketing of oil products. The booklet is well illustrated and thorough in its description of applications of Allegheny stainless steel. It also contains a corrosion resistance chart of stainless steel 18-8 to various media.

Circle letter (BL) on reply card.

(BM) NICKEL DEPOSITS

The International Nickel Company, Inc., has announced a new bulletin titled "Mechanical Properties of Nickel Deposits." It contains 12 pages, with 13 charts, 3 tables, and numerous photomicrographs that show the wide range of properties that may be obtained in electro-deposited nickel by varying the solution and plating procedure. The design engineer will find data on the interrelation of ductility, strength, and hardness in deposits that may be obtained in present-day rapid nickel plating solutions.

Circle letter (BM) on reply card.

(BN) METAL SHORTAGE

Clark Bros. Company, Inc., has published a bulletin containing two articles on the continuing shortage of many critical metals, and the increasing importance of the proper maintenance of any piece of mechanical equipment. One article written by Robert S. Ridgway, Standard Oil Company of California, discusses the problem from the operator's standpoint, and the other article, by Clark sales and service engineers, explains the problem from the compressor manufacturer's viewpoint.

Circle letter (BN) on reply card.

(BO) HIGH-PRESSURE PUMP

Kobe, Inc., division of Dresser Equipment Company has announced the release by its industrial sales and export division, of a new 6-page illustrated bulletin on general industrial applications of the Kobe high-pressure Triplex pump. Shown and discussed in the bulletin are a number of standard applications calling for pressures up to 5000 psi. Described as well are special applications where pressures up to 20,000 psi are required.

Circle letter (BO) on reply card.

(BP) CORROSION-PROOF CEMENTS

A new bulletin providing technical data and catalog information on the four basic types of corrosion-proof cements has just been released by the Atlas Mineral Products Company. Included in the new bulletin are graphic charts showing the temperature range of each cement and its resistance to broad classes of corrosives. Resistance tables rate each cement specifically for 176 common chemical materials. In addition, the three principal acid-proof brick and cement constructions are also shown in association with estimating tables for each construction.

Circle letter (BP) on reply card.

(BQ) HEAT TRANSFER APPARATUS

The Griscom-Russell Company, has just completed a concise picture-book presentation of some of their many designs of heaters, coolers, condensers, and heat exchangers for all types of liquids, vapors, and gases. The material in the bulletin is arranged in sections to show some of the various types of G-R apparatus, which are of particular interest to the oil and gas industry, power plants, general industrial and chemical plants, and the marine industry. The illustrations include views of equipment and installations.

Circle letter (BQ) on reply card.

(BR) CALIBRATOR

A new portable pneumatic instrument calibrator has been developed for calibration and testing of low pressure instruments and controls such as flow meters, draft gages, differential pressure transmitters, with ranges 0-20 in. water-pressure, vacuum or compound. Republic Flow Meters' calibrators are said to be easier to use and more accurate than water column manometers, especially for extremely low pressure calibration. Accurately measures pressure or vacuum in increments of 0.01 in. Essentially a manually operated force-balance, the calibrator consists of a standard chemical weigh scale and an oil sealed bell. Weights on the scale are balanced against an opposing air pressure in the bell.

Circle letter (BR) on reply card.

(BS) POWERED BRAKING SYSTEM

The Wagner Electric Corporation has published a 4-page bulletin on its new powered hydraulic braking system, which takes the leg work out of controlling the bridge motion of overhead traveling cranes. With this system, the company reports, the operator can bring the largest crane to a smooth stop without physical effort; the powered unit provides all the necessary muscle. Wagner powered units can be added to Wagner hydraulic crane-bridge braking systems not in use. Kits containing all necessary parts, with complete installation instructions, are available for 10 by 14-in., 14 by 6-in., and 18 by 8-in. type H and HM systems.

Circle letter (BS) on reply card.

(BT) CONTROL VALVE

Black, Sivalls and Bryson, Inc., announces the publication of a revised edition of the diaphragm control valve section of their BS&B climax control equipment catalog. This section, number 105, shows photographs, sectional drawings, and face-to-face dimensions of the new or completely redesigned items.

Completely new is the Type 87 diaphragm control valve with bellows sealed stem. Another new item is the 115 expanded outlet diaphragm control valve. It has been designed to provide a valve controlling flow of gases.

The company also announces the publication of a revised edition of the pilots and controllers section of their equipment catalog. This section, number 110, shows complete lines of BS&B climax time cycle controllers, pressure controllers, manual remote controllers, vacuum pilots and safety shut-off pilots. The contents are arranged for easy reading and fully illustrated with sectional drawings and photographs.

Circle letter (BT) on reply card.

(BU) RESEARCH INSTRUMENTS

Minneapolis-Honeywell Regulator Company has announced that Bulletin 15-14, "Instruments Accelerate Research", has been augmented to include many items not covered in the previous edition, and has been brought up to date to include the latest designs of various analytical equipment. The bulletin now comprises 96 pages and has complete illustrations with pictures of the latest instrument and equipment in the laboratory, analytical, and measurement fields.

Circle letter (BU) on reply card.

(BV) PROTECTIVE COATINGS

A 44-page catalog entitled "Insul-Mastic In Industry" has just been published by the Insul-Mastic Corporation of America. This company manufactures Gilsonite base protective coatings, and the new book describes these coatings, their properties, their uses and tests to which they have been subjected. Related products such as caulking compounds, primers, and membraning material are also described since they augment the use of the company's coating. Insul-Mastic coatings are used mainly to prevent corrosion of industrial equipment.

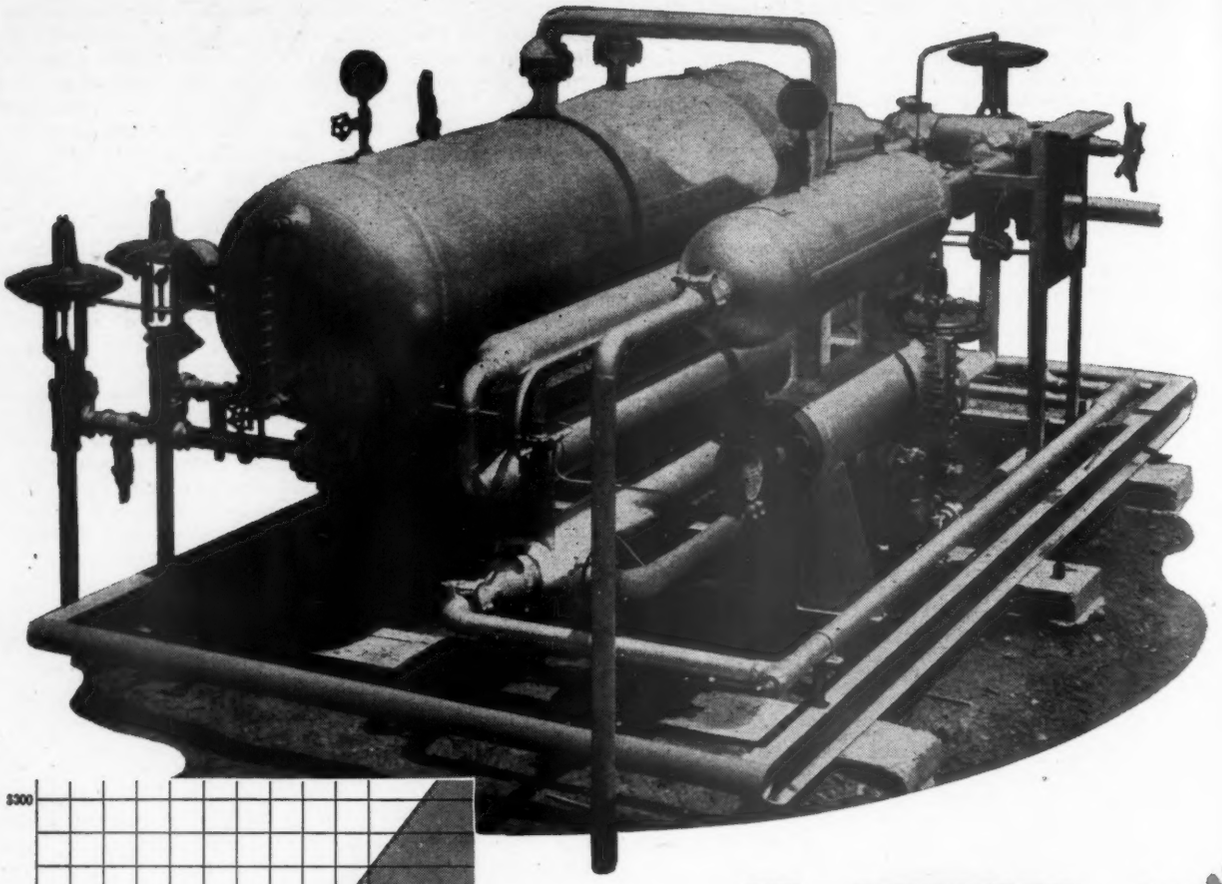
Circle letter (BV) on reply card.

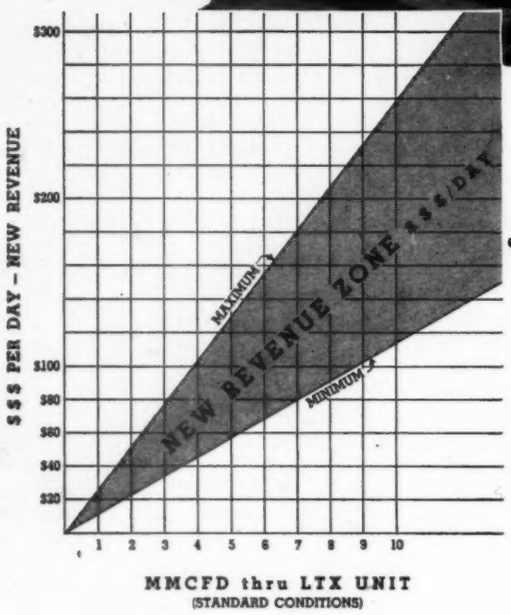
(BW) DATA SHEET

Minneapolis-Honeywell Regulator Company's Instrumentation Data Sheet No. 7.0-4 describes the Shand and Jurs method of supplying an accurate record of mud circulation in oil well drilling operations. The data sheet explains the operation of the Shand and Jurs device as used with Brown recorders. Designed to keep oil well drillers informed concerning mud circulation, the data sheet explains the advantages and features of this equipment. Illustrations of the various components of the equipment and applications are included.

Circle letter (BW) on reply card.

$66.00 Per Day Added Extra Revenue With...





The increase in gross revenue to be obtained from an LTX installation is a function of a number of factors. May we have the opportunity of evaluating your prospect?

...NATIONAL LTX*

This is the first of two 10 MMCF, 1000 psi National LTX Units set on a lease in East Texas. Production figures reveal that the well made 9 bbls. of distillate per MMCF on potential test through standard separation. After setting the National LTX, production increased to 15 bbls./MMCF. The operator flows 4 MMCF/day. This means an increase in distillate recovery of 24 bbls./day valued at approximately $66.00 or $24,090.00 per year.

* T.M. Reg. U.S. Pat. Off.

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